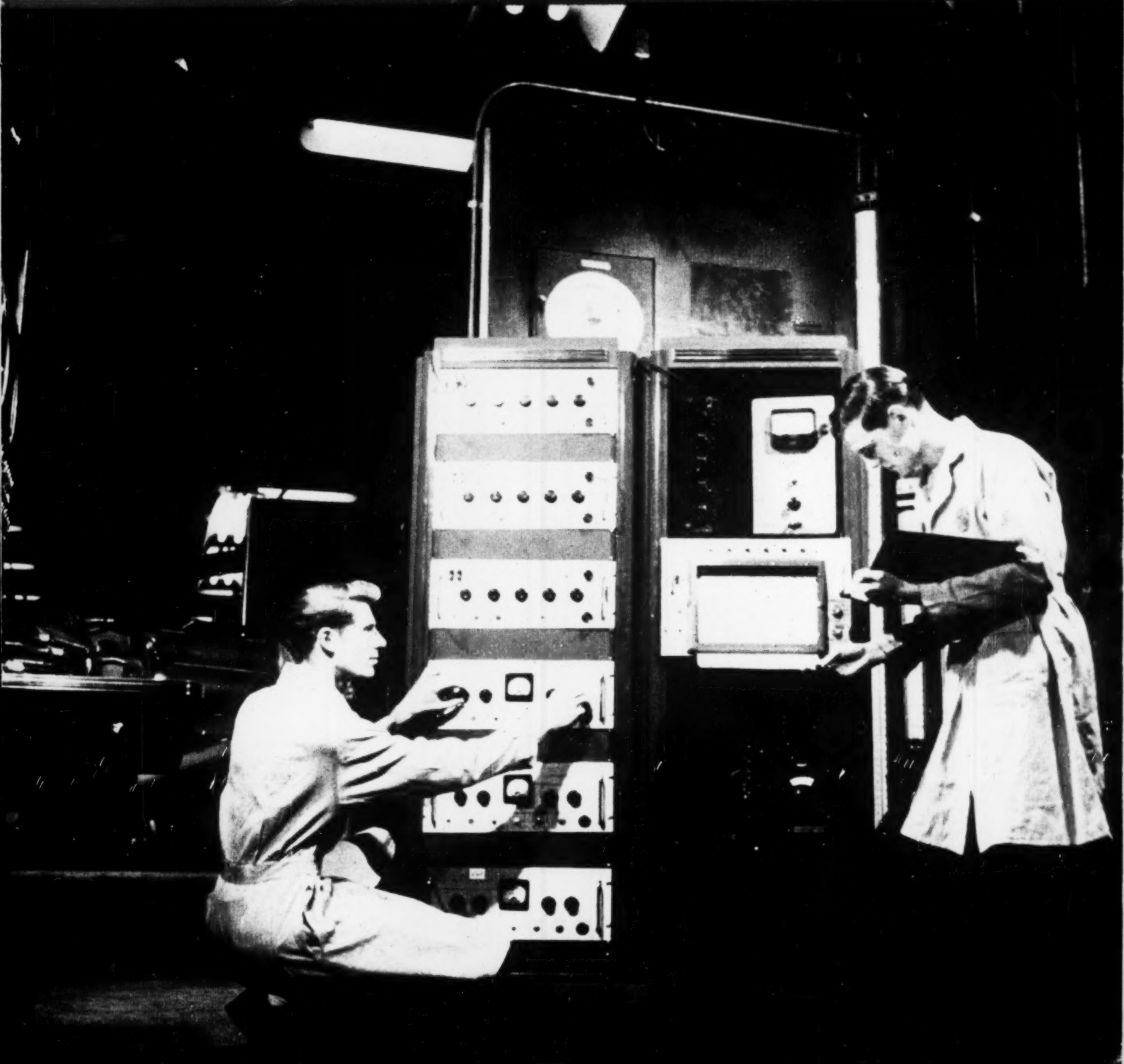
Instruments and AUTOMATION



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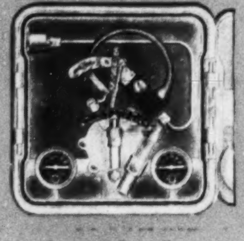
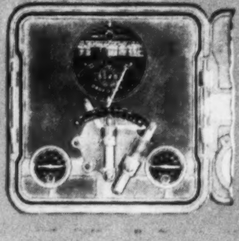
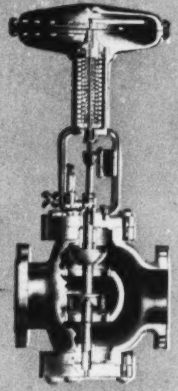
Vent Valves


Pressure Controllers


Liquid Level Control Pilots


Diaphragm Control Valves

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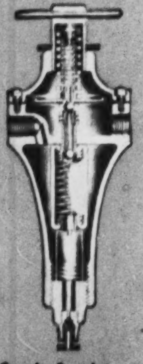
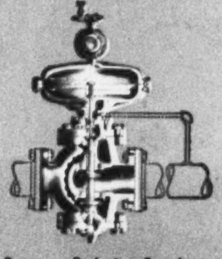
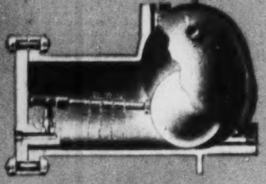
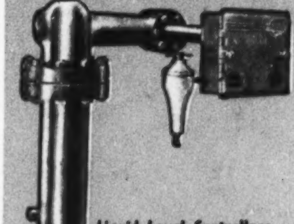
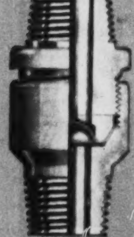
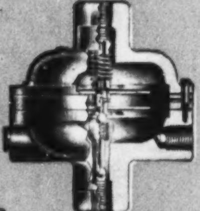

Supply Regulators


Pressure Reducing Regulators


Continuous Drainers


Liquid Level Controllers


Screw Type Safety Heads


Relay Regulators

Bolted Type Safety Heads

Union Type Safety Heads

BLACK, SIVALLS & BRYSON, INC.

Climax Controls Division, Dept. 4-V8

7500 East 12th Street **Kansas City 26, Missouri**

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PYROMETER AND SUPPLY Co.
ALTON ILL
U.S.A

OUR 25th YEAR

Benjamin Franklin Hotel—Main Ball Room

2 BIG NIGHTS Thursday Sept. 16 and Monday Sept. 20—9 p.m. till?

- ★ See our Big Paris Floor Show—"Folies Francois Revue".
- ★ Big Bar—All the finest liquors you can drink.
- ★ Big Buffet Supper—All the turkey, ham and fine foods you can eat.
- ★ Big 10 piece orchestra—Dancing.
- ★ Your Caricature in folder as a souvenir.
- ★ Beautiful girls—Side attractions.

NOTE: Although we engaged the largest ballroom in Philadelphia's largest hotel and while we would like to have all our guests attend both nights as we have always done in the past, this may be impossible this year because of Philadelphia fire law limiting occupancy of ballroom; therefore, when writing for invitations please advise which night you prefer, should we be unable to accommodate you both nights or visit us at Booths 806 and 808 at Convention Hall for invitations possibly available for additional night.

Industrial Pyrometer and Supply Co.

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Worlds largest manufacturer of Pyrometer and Thermocouple Extension Lead Wire

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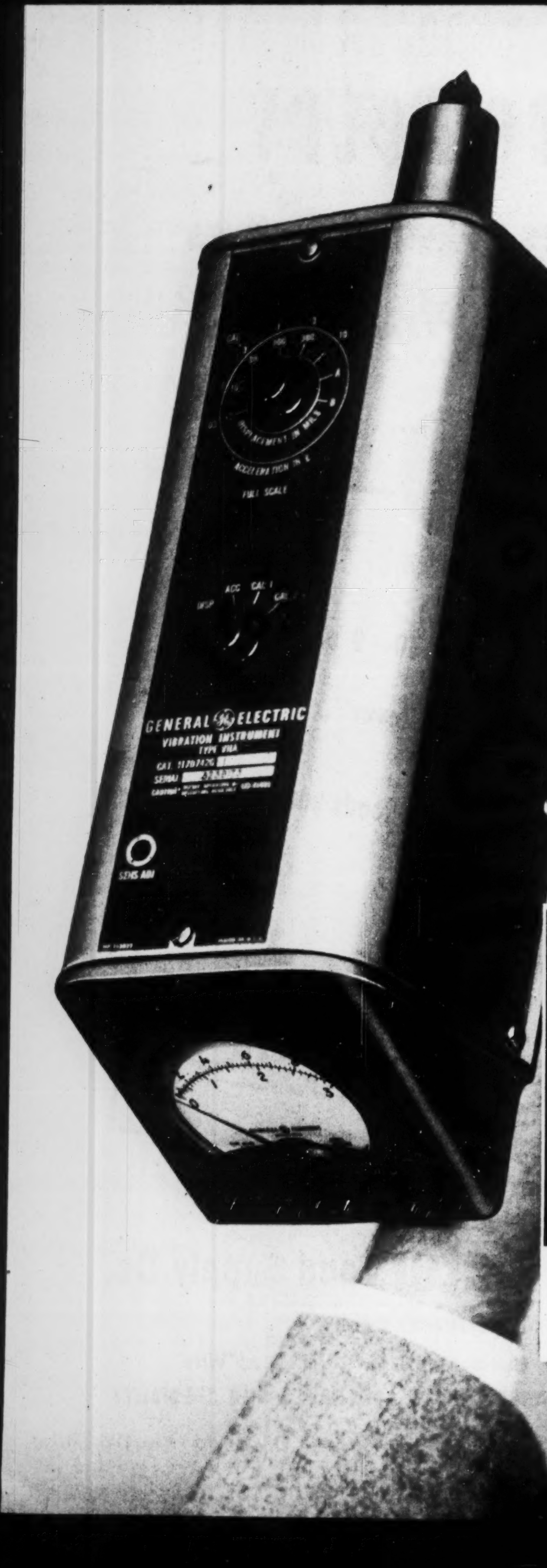
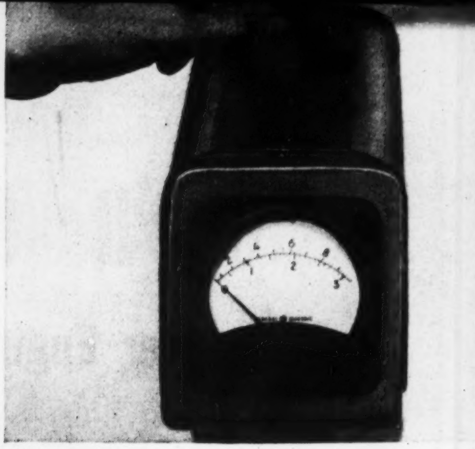
Instruments for Vibration Testing





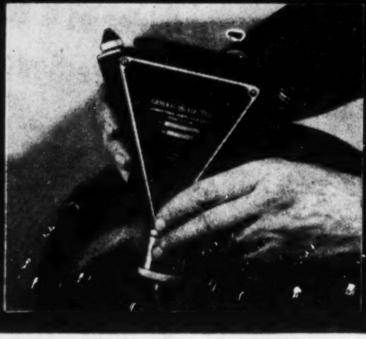
DIRECT READING of vibration measurements is at point of testing and no other instruments are required. The range-changing switch provides five ranges of displacement and six ranges of acceleration measurement.

CUT REJECT AND MAINTENANCE COSTS

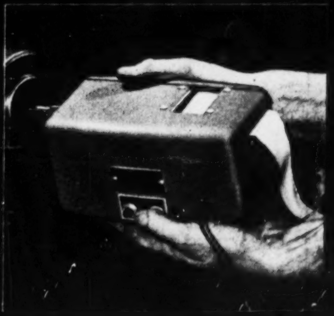
Excessive vibrations of your products and capital machinery can easily result in poor quality and even shutdowns if not discovered promptly. The new G-E portable vibration meter provides a completely self-contained means of obtaining vibration measurements over a frequency range of 10 to 250 cycles per second.

No trained operators are required for this simplified instrument. All the operator need do is turn the selector switch to "Displacement" or "Acceleration" and press the switch on the pistol-grip handle.

MORE NEWS ABOUT

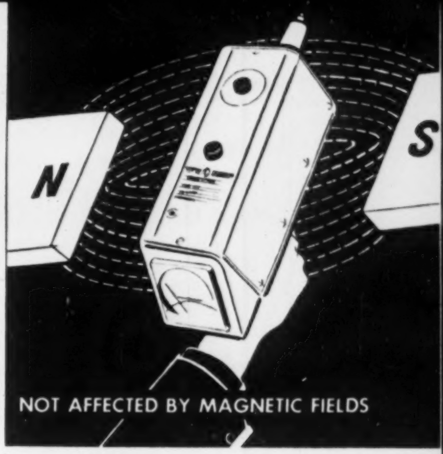


LIGHT-BEAM VIBRATION INDICATOR locates points of excessive machinery vibration. Available with either of two scales: 0–15 or 0–30 mils. The frequency response is 15 to 250 cps.



RECORDING VIBROMETER measures and records frequency, displacement, and wave shape of mechanical vibration. Frequency range: 10 to 120 cps.

WIDE VARIETY OF APPLICATIONS is possible for both testing and inspection of plant equipment. This new instrument is exceptionally versatile because of its high accuracy at low scales. It is especially valuable in installing and maintaining rotating and reciprocating equipment. Typical industrial applications range from motors (left) to turbine-generators (above). Portability permits convenient use in laboratory or factory.


N
S
NOT AFFECTED BY MAGNETIC FIELDS

NOT MAGNETIC-SENSITIVE, the new meter is ideal for vibration measurements in areas of stray fields and in the vicinity of magnetic coils. Common hearing-aid batteries will operate this instrument for 20 hours.

General Electric Announces . . . .

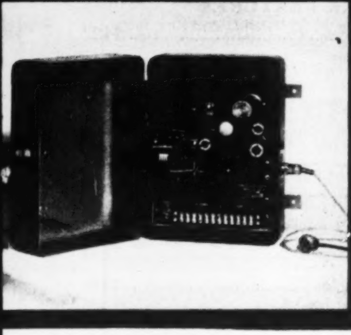
New Portable Vibration Meter

for direct reading of acceleration and displacement

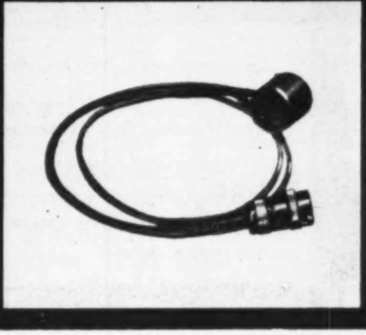
The new General Electric portable vibration meter provides a quick, simplified means of locating excessive—and costly—machinery vibrations.

Designed for use on production tests or your plant equipment, this new instrument gives a degree of sensitivity never before offered in a hand-held vibration meter. In measuring *both* displacement *and* acceleration, this new equipment will measure 3 to 300 mils peak-to-peak displacement and 0.03 to 10 G peak acceleration, full-scale values. Readings of ¼ mil can be obtained.

OTHER G-E VIBRATION INSTRUMENTS



VIBRATION RELAY helps protect normally unattended equipment by initiating a signal when excessive vibration occurs. Frequency range of relay is 5 to 300 cps.



VIBRATION DETECTOR is a lightweight crystal accelerometer used with associated equipment in measuring acceleration. The frequency response is less than 1 decibel rise at 1000 cps.

GENERAL ELECTRIC COMPANY, Section B605-70
SCHENECTADY 5, NEW YORK

Please send me a copy of the bulletin(s) checked below:

- ☐ **GEC-1247 Portable Vibration Meter**
- ☐ **GEC-1212 Vibration Detector**
- ☐ **GEC-1204 Vibration Relay**
- ☐ **GEC-853 Vibration-measuring Equipment**
- ☐ **GEC-1016 Measuring Equipment Catalog**

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CITY...**ZONE**..........**STATE**..........

SEE THESE AND OTHER G-E INSTRUMENTS at the Instrument Society of America Show, September 15–21, Commercial Museum, Philadelphia, booths 531–537.

GENERAL ELECTRIC

For more information circle **2** on inquiry card.

Figure on FALSTROM for–

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FALSTROM STANDARD PRODUCTION METHODS

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Specifying FALSTROM for your metal products requirements means you obtain quality production with a maximum of economy. FALSTROM production techniques make use of stock tools and dies, standardized formed construction methods and standard detailed drawings wherever possible. For complete information on FALSTROM facilities, request new Bulletin 142; for a recommendation on a specific assembly, send blueprints or sketches – no obligation.

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of Instrument Panels, Control Boards, Transmitter Cabinets, Consoles and Power Frames, and Custom Assemblies.

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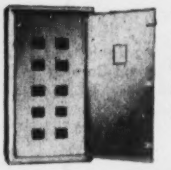

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Instruments and **AUTOMATION**

Vol. 27 **August, 1954** No. 8

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by R. L. Bright

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JOURNAL of the
SOUTHERN CALIFORNIA METER ASSOCIATION

Flowmeter Rangeability 1319
by E. A. Ford

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LEWIS

SELECTOR SWITCHES
FOR
RESISTANCE THERMOMETERS
AND
THERMOCOUPLE THERMOMETERS

EACH SWITCH HAS "OFF" POSITION PLUS NUMBER OF POINTS LISTED.

		Switch Part Numbers	
Points	Size	Thermocouple Type	3 Wire Resistance-Thermometer Type
2	2″	11S2	36SR2
3	2″	11S3	36SR3
4	2″	11S4	36SR4
5	3″	10S5	37SR5
6	3″	10S6	37SR6
8	3″	10S8	37SR8
9	3″	10S9	37SR9
10	3″	10S10	37SR10
12	3″	10S12	37SR12
16	3″	10S16	37SR16
18	3″	10S18	37SR18
20	3″	10S20	37SR20
24	4″	27S24B2	38SR24
28	4″	27S28B4	38SR28
40	4″	38S2C	

(No. 38S2C is made with soldering-lug terminals)

2" SIZE

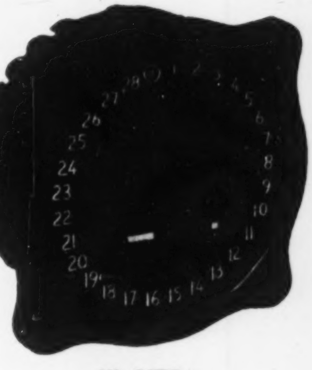
3" SIZE

SPECIAL SWITCHES

No. 37S6C2, Four "4 Point and OFF" thermocouple switches combined in one 3″ case.

No. 9S5, Single Pole, Four Point Instrument Switch in 1¼″ round case.

No. 44S4, Six Pole, Double-throw Instrument Switch in 2½″ round case, one hole mounting, ½-32 threaded bushing.


4" SIZE

DESIGNED FOR TEST WORK AS WELL AS FOR PERMANENT INSTALLATIONS. LEWIS SELECTOR SWITCHES ARE CONSTRUCTED WITH STURDY CONTACTS OF LOW RESISTANCE AND POSITIVE DETENT. THESE SWITCHES ARE SPLASHPROOF, DUSTPROOF AND ARE BUILT TO GIVE YEARS OF SERVICE.

THE LEWIS ENGINEERING CO.
Specialists in Electrical Temperature Measurements
NAUGATUCK, CONNECTICUT

For more information circle 4 on inquiry card.

WANT MAXIMUM PERFORMANCE IN MINIMUM SPACE AND WEIGHT?

TYPE 4BQA
POWER D. C.
SMALL, LIGHT—CONTACTS HANDLE HIGH CURRENT

THESE Phil-trol Relays HAVE IT!

TYPE 4BQA
MULTI-CONTACT D. C
SMALL, LIGHT
SENSITIVE

Phil-trol
Phil-trol
END VIEW
SIDE VIEW
2QA Relay
6QA Relay
4BQA Relay
27QA Relay
Hermetically Sealed Relay
3QA Relay
33AC Relay
4QA Relay
4BQA Power Relay
Actuators

Among the wide variety of *Standard* Phil-Trol Relays you will find many designed to solve your "special" problems . . . like the types 4BQA and 4BQA POWER shown above. While both are small, compact, lightweight units, each is designed to perform its job best. For example:

The 4BQA Multi-contact D.C. is used where very sensitive or marginal operate and release factors are required. This relay may be provided in multicontact combinations with as many as 12 contacts.

The 4BQA Power Type D.C. has the capacity to handle large currents on the contacts. Standard contacts are rated at 25 amperes.

These are but two of the many unusual Phil-Trol designed relays that will help you solve the "tough" application problems as well as the simpler ones . . . and with security in knowing you will always have dependable performance. Send for a new Phil-Trol Catalog — today!

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Dept. IA, Joliet, Illinois
Please send me a free copy of the new Phil-Trol Relay and Actuator Catalog. Also, please arrange to have a Phil-Trol Sales Engineer call on me.

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Company ....

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Instruments and AUTOMATION

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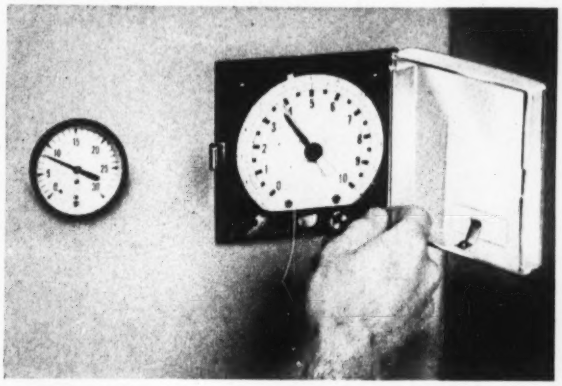
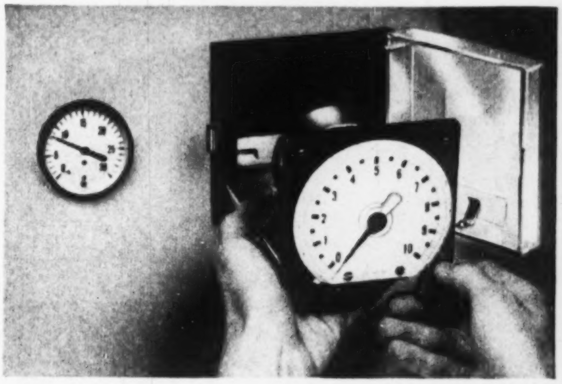
You can replace your Metagraphic indicator with a recorder—

in less than 10 seconds . . . with no pressure loss

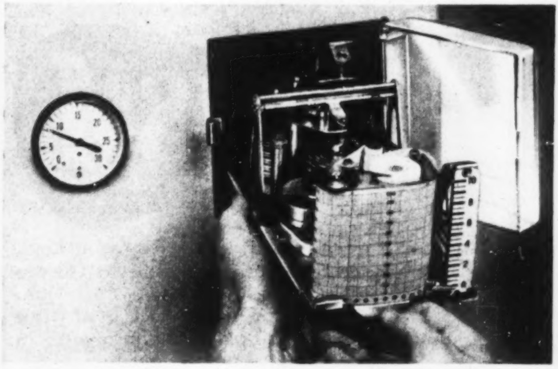
Let's say your graphic-panel-controlled process is at a critical stage. You've got a Metagraphic Indicator in the panel but now you want a *record* of every variation – and you can't afford to upset control. With Bristol's human-engineered Metagraphic system, here's all you have to do:



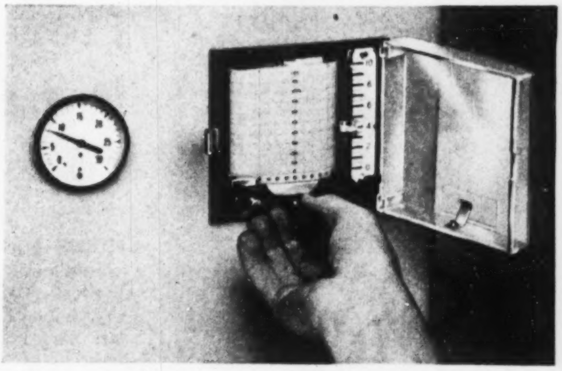
TIME—00:00 Open case door, twist retaining latch securing indicator chassis to case. (Note pressure gage reading.)



TIME—00:02 Pull out indicator chassis. Connections are automatically sealed off. Valve-top pressure stays constant.



TIME—00:05 Slide the Metagraphic recorder chassis into the case. All plug-in connections are made automatically. (Now note that the pressure gage still reads the same.)



TIME—00:08 Push recorder all the way in, fasten latch. Changeover is complete, with no pressure loss, no disturbance of control. In fact, you don't even have to go off automatic control.

4.34

And less than 10 seconds have elapsed! You can get the complete story on Bristol's Metagraphic instruments by writing for Bulletin A106. The Bristol Company, 113 Bristol Road, Waterbury 20, Conn.

BRISTOL *POINTS THE WAY IN HUMAN-ENGINEERED INSTRUMENTATION*

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

For more information circle 6 on inquiry card.

Here's why it pays *to know your* HSM

HONEYWELL SUPPLIES MAN

FRANK LONG, HSM (Honeywell Supplies Man) in the Houston area, points out features of Brown thermocouple extension wire to George Hubert (right), Instrument Supervisor at Eastern States Petroleum Company, Houston, Texas . . . explains how the wide selection of wires lets you choose the type that fits any application requirements in your plant.

Personalized, expert service on all your pyrometer supplies problems is the keynote of the HSM Plan. Your HSM not only keeps you informed on the latest developments in Brown equipment and helps you select the types best fitted to your applications . . . but also helps you to buy all your supplies the most convenient and economical way.

Your nearby HSM will be glad to discuss how this plan can work in your own plant. Call him today at your local Honeywell office . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.

● **REFERENCE DATA:** Write for Pyrometer Supplies Buyers Guide No. 100-5, and for new booklet, "The HSM Plan for Purchasing Pyrometer Supplies."

H HONEYWELL

MINNEAPOLIS
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BROWN INSTRUMENTS

First in Controls

ACHIEVED!

A Scanning System That Instantly, Graphically Presents All Process Variables

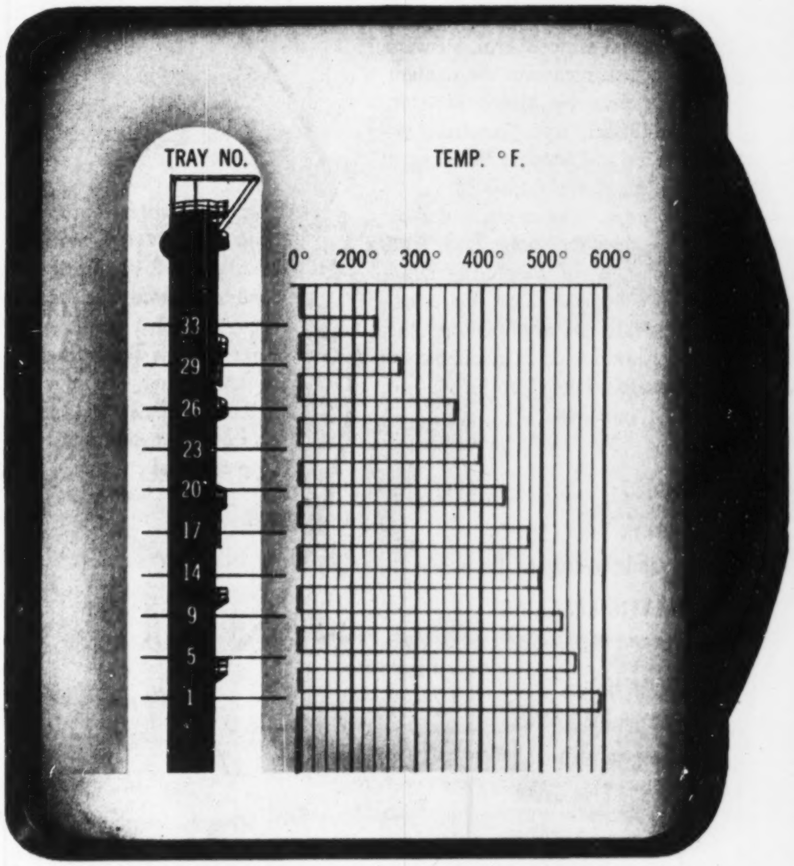
Now! Higher speed scanning than ever before with the Kybernetes Electronic Scanning System.* Permits graphic representation of all variables on scope. You see and hear your process operation.

Completely electronic. Scans each of any number of points 60 times per second. You secure uninterrupted scanning, continuous protection and alarm indication throughout logging, recording, and point reading. There is continuous qualitative and quantitative scope display of all process variables. The Kybernetes Electronic Scanning System is readily miniaturized and JANized for airborne and other equipment.

Transmitters, 8" x 8" x 12", are packaged in convenient 4 point plug in units.

You may use the Kybernetes Electronic Scanning System to more efficiently and effectively monitor temperature, flow, level, pressure, viscosity, pH, concentration, conductivity, radiation, gas analysis, and other process variables.

For Specific Information applicable to your own monitoring requirements, write today.



This illustration shows just one of many Kybernetes Electronic Scanning System applications: signal sources from trays of fractionating column. Two or more trains of pulses may be simultaneously exhibited on one viewing tube.

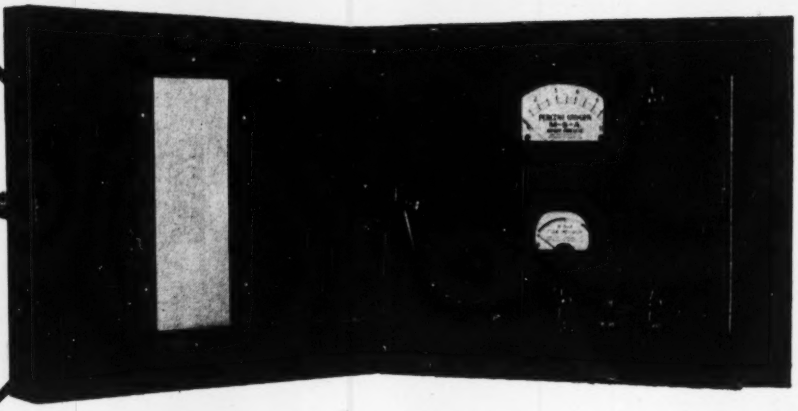
VISIT OUR BOOTH NO.
243
INSTRUMENTS SHOW, PHILA.

The KYBERNETES Corporation · DIVISION OF SELF WINDING CLOCK CO., INC. (*PATENT PENDING)
1100 RAYMOND BOULEVARD, NEWARK 5, NEW JERSEY (OPPOSITE PRR STATION)

For more information circle 8 on inquiry card.

← For more information circle 7 on inquiry card.

FOR ACCURATE,
CONTINUOUS,
MEASUREMENT
OF THE
OXYGEN CONTENT OF
GASEOUS MIXTURES



THE M·S·A OXYGEN INDICATOR

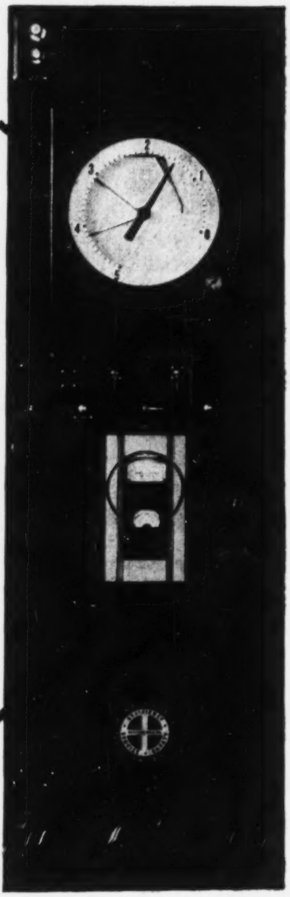
This instrument, newest in M.S.A.'s product line of devices for measuring the oxygen content of industrial atmospheres, answers a variety of needs. It measures the content of inert and combustible atmospheres in chemical, metallurgical and petroleum industries. It checks and records the oxygen content of fuel gases for improved safety in utility operations. The control of pipe line corrosion is another application. And the instrument's use for measuring combustion efficiency helps save on fuel costs.

To accommodate all applications, the M.S.A. Oxygen Indicator is available in the following scale ranges: 0 to 1.0%, 0 to 5.0%, 0 to 10%, and 0 to 25%.

APPLICATIONS:

- HYDROGENATION PROCESS
  0 to 1% Oxygen in Hydrogen
- FLUID CATALYTIC CRACKING
  0 to 1% Oxygen in Regenerator Flue Gases
- INERT GAS CONTROL
  0 to 1% Oxygen in Inert Gases
- COMBUSTION CONTROL
  0 to 1% Oxygen in Flue Gases

This instrument can be supplied complete with steel panel and base, with all accessories assembled, wired and permanently mounted on the panel. An electronic recording potentiometer may be mounted in the panel if desired. Recorders can be supplied with either strip or round charts.



MSA
SAFETY EQUIPMENT HEADQUARTERS

Call the M.S.A. man on your every gas analyzing problem . . . his job is to help you.

MINE SAFETY APPLIANCES COMPANY
201 North Braddock Avenue, Pittsburgh 8, Pa.
At Your Service: 76 Branch Offices in the United States
MINE SAFETY APPLIANCES CO. OF CANADA, LTD.
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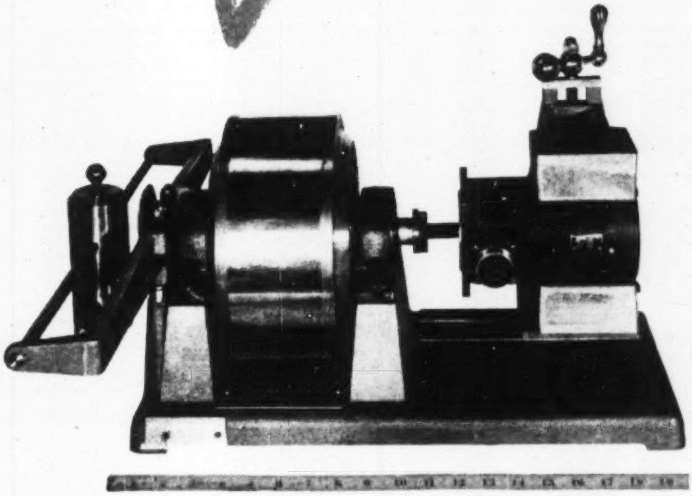
For more information circle 9 on inquiry card.

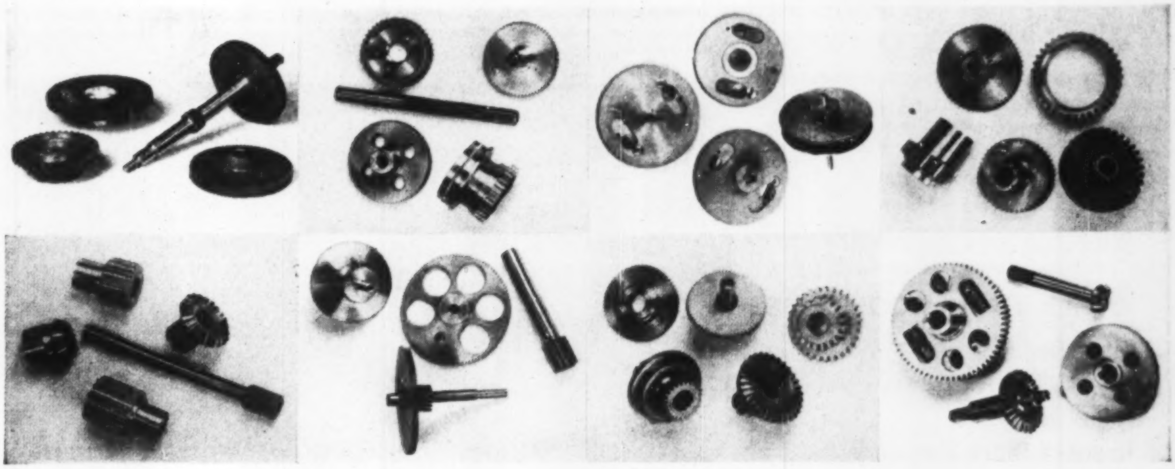
For specialized electronic equipment...

check Western Gear



Dyna-Chek **provides tested and proven accuracy in measuring the output of fractional and integral horsepower motors—**

Model DM4 up to 1HP in continuous duty, and Model MDM for 1/10 HP or less. Manufactured by Mission-Western Engineers, Inc.,* Dyna-Chek provides a simple and convenient method of motor testing. Two types of broad range speed measuring equipment available as extra accessories, both supplying a high degree of accuracy. For information, address Mission-Western Engineers, Inc.,
132 W. Colorado, Pasadena 1, Calif.



HIGH PRECISION GEARS ***and precision fine pitch gearing*** from 200 to 6 diametral pitch and dimensions from .125" to 10" diameter. Western Gear Works makes available complete engineering and manufacturing facilities for the application of high precision gearing and gear drives in electronics equipment. For assistance without obligation write Executive Offices, Western Gear Works,
P.O. Box 182, Lynwood, Calif.

Since 1888

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** An affiliate of Western Gear Works, since 1888 a leader in the mechanical power transmission field.*

PLANTS AT LYNWOOD, PASADENA, BELMONT, SAN FRANCISCO (CALIF.), SEATTLE, HOUSTON — REPRESENTATIVES IN PRINCIPAL CITIES

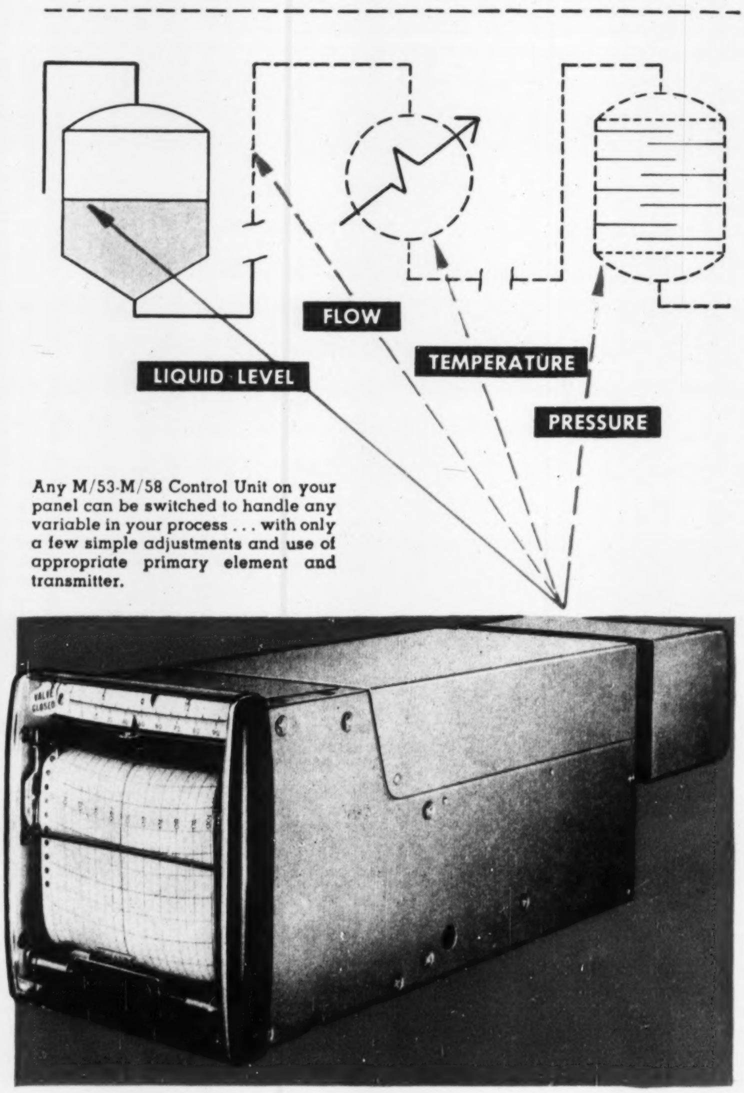
For more information circle **10** on inquiry card.

No obsolescence for this controller when process requirements change!

That's right! The Foxboro M/53-M/58 Recorder-Controller is a "universal" instrument, equally adaptable to any process measurement — whether flow, temperature, pressure, liquid level, or other.

All it takes is connection to the proper measurement transmitter having a 3-15 psi pneumatic signal . . . and making the appropriate controller settings. Changes such as adding derivative to reset or proportional control can be made *on the job* without special tools or realignments. You save needless duplication in capital investment . . . save time and trouble in making process revamps . . . and get the unsurpassed performance of M/58 control on every application!

Whether you favor graphic, console, or conventional mounting, you can cut instrument overhead at every stage, step-up efficiency in every operation, with the Foxboro M/53-M/58 Recorder-Controller. Write for complete information. **The Foxboro Company, 468 Neponset Ave., Foxboro, Mass., U.S.A.**



Any M/53-M/58 Control Unit on your panel can be switched to handle any variable in your process . . . with only a few simple adjustments and use of appropriate primary element and transmitter.

OTHER BASIC ECONOMIES

- **Simplified Ordering**
  —complex specification sheets are eliminated.
- **Reduced Stock Inventory**
  —only one type recorder-controller for all control jobs.
- **Reduced Maintenance**
  —fewest parts, rugged design, no diaphragms, highest quality throughout.

FOXBORO
REG. U. S. PAT. OFF.

**Consotrol
Process
Control**

FACTORIES IN THE UNITED STATES, CANADA AND ENGLAND

For more information circle **11** on inquiry card.

Trends...

Instruments and AUTOMATION

Pipeline instrumentation is expanding, including unattended automatic pumping stations operated by microwave and telephone-line telemetering. Pipeline network analyzers are finding use in network calculations. Radioactive isotopes are being used for locating batches in stream, and automatically controlling booster stations. Radiographic inspection was used on more than 12,000 miles of pipeline in 1953; more than 10,000 miles of microwave telemetering and control lines are in use. New aerial survey techniques include use of airborne profile recorders.

Insurance Company (Liberty Mutual) offers research service to its industrial customers. Electronic computers and data processors will be used to study noise, physiology (labor fatigue), machine design, etc. to reduce casualties and losses.

Decreasing labor population means more need for automation. "Ratio of U. S. labor force to total population will be about 14% less by 1963, causing shortage of labor and accenting need for . . . mechanization," says S. P. J. Wood, president, Warner Electric Brake & Clutch Co., Wis. Also, growing total population means greater markets.

Technical advances bar slump, said A. M. Wilson, vice-president of Minneapolis-Honeywell Regulator Co., before New York Society of Security Analysts. Billions spent on military research flow into civilian application, converting military strength into productive leadership. It also accelerates technological obsolescence, which in turn keeps capital spending high. Wilson estimates that $16 billion of $26.5 billion capital spending projected for 1954 will go into modernization of facilities.

Highlights of an expanding industry—Brush Electronics Co. purchases Digital Instrument Co. of Coral Gables, Fla.—Foxboro opens new 13,000-sq.-ft. branch office in Dallas.—U. S. Engineering Co. completes new plant.—Electronic Engineering Co. of Calif. announces net profit for 1st quarter of 1954 is equal to 64 percent of total 1953 profits after taxes—Gudeman Co. of Calif. opens new lab and plant in Los Angeles—Aeroquip Corp. has acquired plant of Sterling Electric Motors at Van Wert, Ohio—Robertshaw-Fulton Controls Ltd. of Canada has acquired 30,000-sq.-ft. plant in Toronto—Burroughs Corp. acquires Haydu Bros. of Plainfield, N. J.—American Gyro Corp. has acquired larger 20,000-sq.-ft. plant in Santa Monica—Automatic Control and Uni-Flo Div. of Barber-Colman opens new branch office in Birmingham—U. S. Relay Co. opens new laboratory in Los Angeles—Hazatrol Corp. establishes new plant in San Francisco—Ramo-Wooldridge Corp. is constructing new 150,000-sq.-ft. plant in Los Angeles.—$1.5 million contract for a centralized data processing system at AF Flight Test Center, Edwards Air Force Base, was awarded to Electronic Engineering Co. of Calif.—Sales by Clary Multiplier Corp. of servomechanisms components were highest in company's history in June, and mounting; backlog of instrument orders exceeds $4 million.

Watch for dramatic news about new uses for computers in process industries. First computer clinic (see page 1171) offers opportunity for Instrument and Process Engineers to learn new techniques.

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Modern design.... Accepted for dependability... Certified Safe

REALISTICALLY PRICED!

FULL-NOZZLE

Sizes 1" D 1½", to 8" T 10"

SEMI-NOZZLE

Sizes 1½" F 2", to 6" S 8"

BAR STOCK & HI-PRESSURE

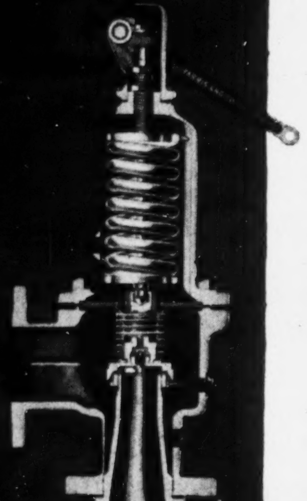
Type 2745—½", ¾", 1"
Type 2740—½" x 1", ¾" x 1", 1" x 1", 1" x 1½"
Type 1430—1¼", 1½", 2"

CORROSION TYPES

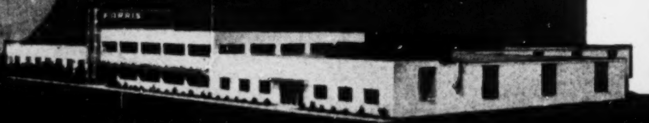
Type 1000—½" to 2"
Type 3725—½" to 1"
Type 3775—1½" to 2"

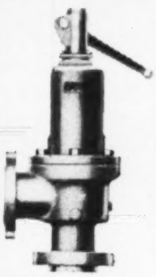
GENERAL SERVICES

Sizes ½" to 6" x 8"



Farris



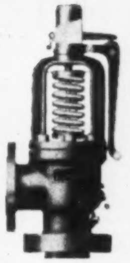


TYPE 2680

Made in Series 30, 60, 90 and 150 inlet flanges, R.F. and R.T.J. Series 15 outlet standard. Available with "FarriSeal" or "BalanSeal" bellows—with or without internal heat exchanger coil; stainless steel, Monel and Hastelloy trim. Plain or packed cap, and open lever types.

TYPE 2610

Made in Series 15 and 30 inlet flanges. Series 15 outlet standard. Parts interchangeable with heavy series valves. Full capacity, economical, for medium pressure range.

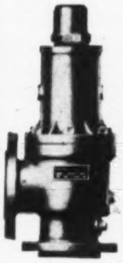


TYPES 2575 to 2578— Series A, B, C

A.S.M.E.—N.B. Steam Generator Safety Valve. Complies with A.S.M.E. Code for fired pressure vessels. The suffix A indicates maximum temperature of 650°. B indicates 750°, using alloy spring; C indicates 900°, using alloy spring and carbon-moly. body. Pressure limits:

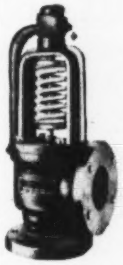
2575—300# 2576—450#
2577—600# 2578—900#

These valves are famous for their non-sticking qualities. Available in oversize orifices for greater capacity at slight additional charge.



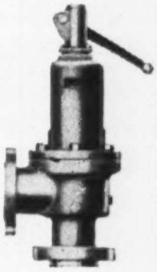
TYPE 2550

Made in Series 250 inlet, 125 outlet. Female outlet size available up to 4". Iron body, bronze or stainless steel trim. (Bronze trim has stainless steel disc as standard.) Stainless steel trimmed valves available with "FarriSeal" or "BalanSeal" bellows, with or without internal heat exchanger coil. Capacity advantages of full nozzle design



TYPE 2250

A.S.M.E.—N.B. Exposed Spring Boiler Safety Valve. 250# inlet, 125# female outlet to 4". Pressure and temperature limits 250# at 450°F. Available in stainless steel or bronze trim. Stainless disc on bronze trim, standard.



TYPES 2570 & 2550 - OL

Made in Series 250 inlet, 125 outlet. Female outlet size available up to 4". Iron body, bronze or stainless steel trim. (Bronze trim has stainless steel disc as standard.) Stainless steel trimmed valves available with "FarriSeal" or "BalanSeal" bellows, with or without internal heat exchanger coil. Capacity advantages of full nozzle design. Type 2550 - OL—Open Lever Construction; Type 2570—Packed Cap and Lever Construction.

TYPE 2745

Sizes ½", ¾" orifice No. 8 (area .019), No. 13 (area .077). 1" orifice No. 12 (area .045), No. 20 (area .250). By far the most outstanding advance in Safety Valve achievement. Nozzle capacity, blow down ring control, self aligning loose disc construction. Made from forged bar stock in four materials: brass, 304 and 316 stainless steel and cold rolled steel. Internal trim, 316 stainless steel. Both pipe connections in body for economical maintenance suitable for pressures to 10,000# on air, gas, oil and water. Type 2747—Packed Cap and Lever Construction.

TYPE 2740

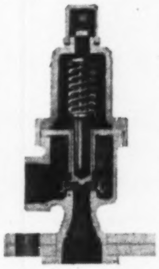
½" x 1", ¾" x 1" with .049 area, 1" x 1" and 1" x 1½" with .18 area. A rugged, simplified design, limited capacity Safety-Relief Valve. Used by refineries particularly where extreme accuracy of blow-down is not essential. Uses: thermal reliefs, pump by-passes, etc.

TYPE 1430

Sizes 1¼", 1½", 2" female inlet and outlet. Heavy duty Safety-Relief Valve, cast steel body, stainless steel trim, with flat seat and disc and blow-down ring for pressures up to 600#. Both pipe connections in body for economical maintenance. For gas or liquid service.

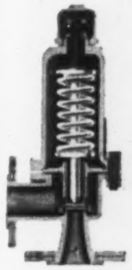
TYPE 1000

Diaphragm Control Relief Valve, sizes ½" to 2" male inlet, female outlet on bronze, 15 series inlet, 15 series outlet on Hastelloy "C" and type 316 stainless steel. Sensitive control with minimum bleed down. For chemical vapor-tight service—liquid or gas. Available with rubber, Neoprene, or molded Kel-F diaphragm and disc.



TYPE 3725

½" and ¾" orifice No. 13 (area .077). 1" orifice No. 20 (area .25). Made in female connections or Series 15, 30 or 60 flanges inlet. With rubber, Neoprene, or stainless steel "FarriSeal" bellows, Hastelloy "C" or 316 stainless steel body and disc. For highly corrosive acid services within the scope of 316 stainless steel and Hastelloy "C".



TYPE 3775

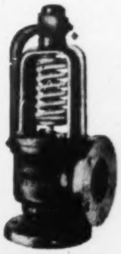
Sizes 1½" to 2", H orifice (area .785). Series 15, 30 or 60 inlet. Series 15 outlet. Rubber, Neoprene or 316 stainless steel "FarriSeal" bellows. Hastelloy "C" or 316 stainless steel body and disc. For highly corrosive acid services within the scope of 316 stainless steel and Hastelloy "C".

TYPE 1808

Sizes ½" to 2½". All Bronze Portable Pop Safety Valve. Male inlet, female outlet. A.S.M.E.—N.B. for steam or air services. Precise operation, economical first cost. Pressure to 250# steam.

TYPE 1400

Sizes ½" to 2½". Low Pressure Liquid Relief Valve, all bronze. Compact, adjustable range. Can be inspected and serviced without breaking pipe connection. Pressures to 250#.

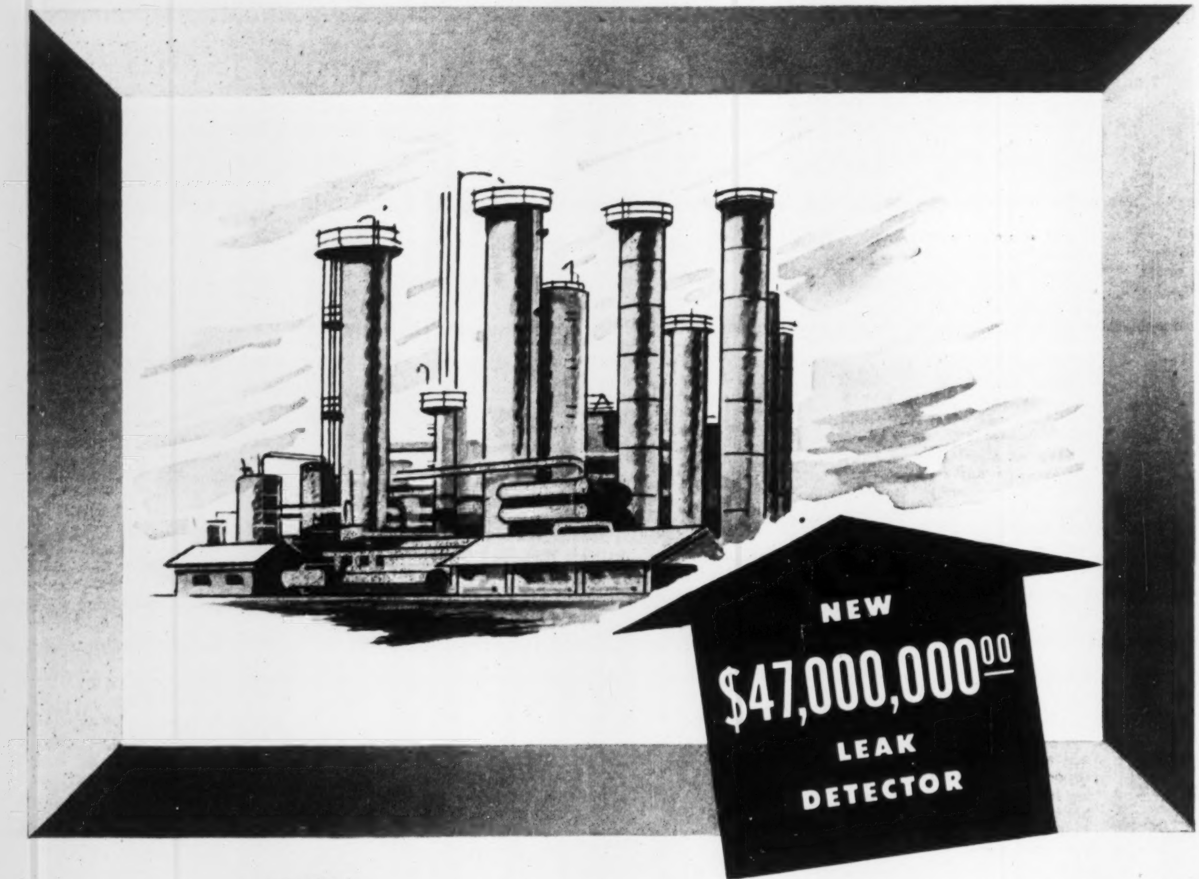


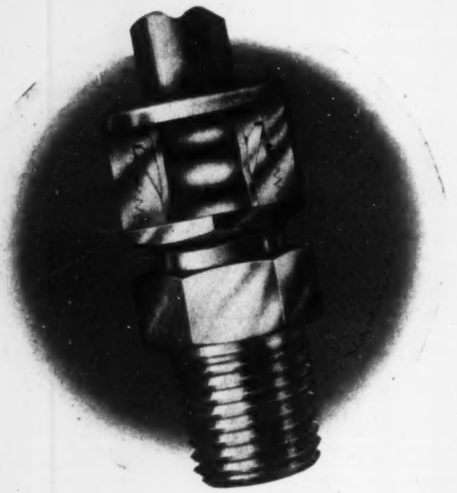
TYPE 2350

Sizes 1½" x 2" to 6" x 8". Wing guided construction cast iron body, bronze trim. A.S.M.E. — N.B. Boiler Safety Valve, exposed spring, test lever. 250# inlet, 125# or female outlet to 4"

TYPE 2469

Sizes 1½" x 2" to 6" x 8". Wing guided construction, enclosed spring, test lever. A.S.M.E. — N.B. Cast iron body, bronze trim, 250# inlet, 125# or female outlet to 4".





This foolproof leak-detecting device is guaranteed to locate most of your leaks very quickly. To locate leaks, you merely pipe up the plant, then check each joint for a tight seal. Most leaks will show up on this device at start-up time. Those that are not found at start-up will usually be found as soon as the plant is in operation; vibration will make it easier for you to find the leaks.

This seems like an expensive way to find leaks when you consider that the leaks could be prevented by specifying Swagelok Tube Fittings.

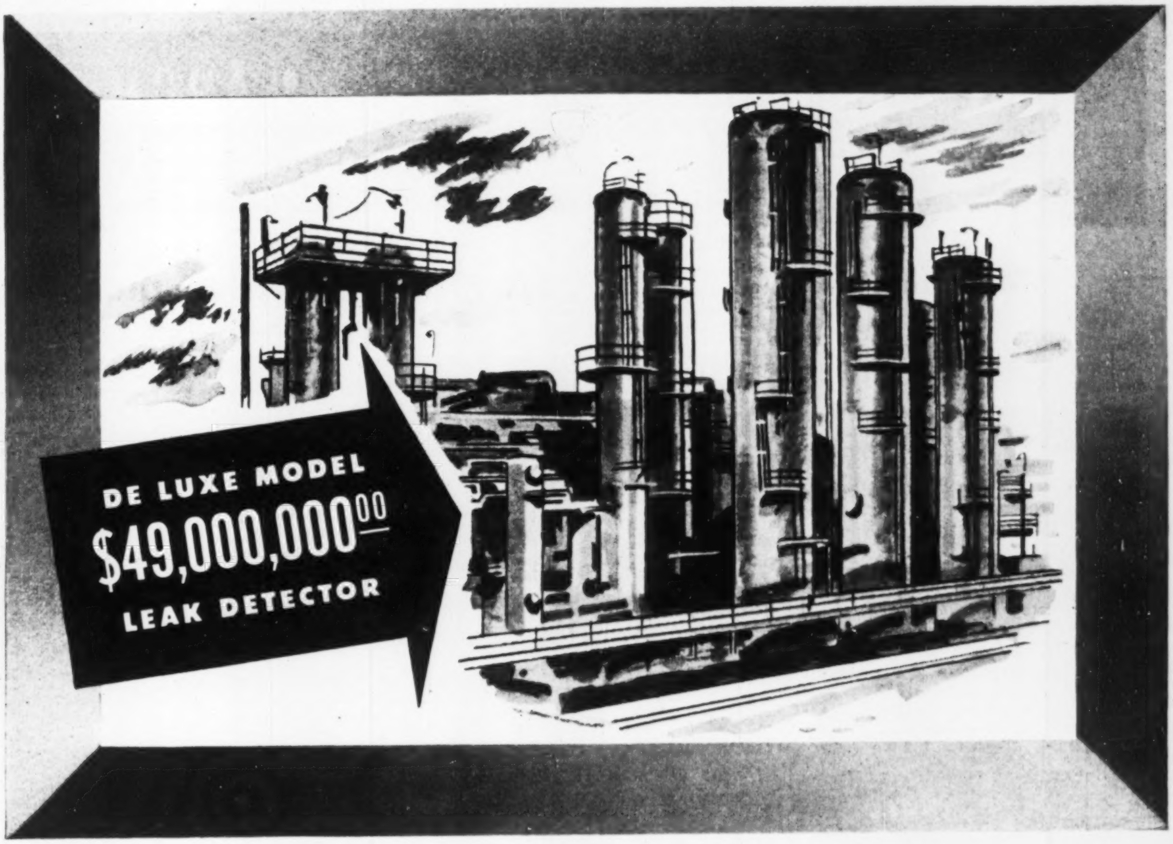
Leaks are expensive. Stop them before they happen. Specify Swagelok.

Swagelok®

TUBE FITTINGS

BRASS • ALUMINUM • STEEL
STAINLESS STEEL • MONEL

For more information circle **13** on inquiry card.



While this leak-detecting device carries a $49,000,000.00 price tag, it is worth every penny of it! This device will not find leaks any faster than lower-priced models, but it will usually find more of them.

Leaks are expensive. Why not specify Swagelok Fittings and stop leaks before they happen?

Write for the Swagelok Catalog today. Address Department R.

For Your Convenience During First International Instrument Congress and Exhibit—September 13-24:

FREE BUS TRANSPORTATION is being provided by Crawford Fitting Company between hotels and the Convention Hall. Busses will run every ten minutes during the hours of technical sessions and exhibits. The schedules and routes of Swagelok busses will be posted in hotel lobbies.

You are invited to visit Swagelok Booths 704-705.

CRAWFORD FITTING CO.
884 EAST 140TH ST.
CLEVELAND 10, OHIO

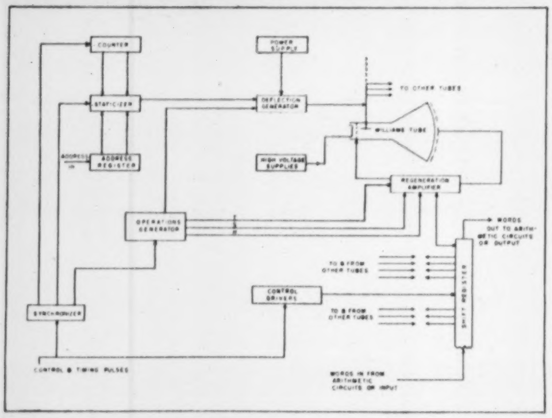
For more information circle 13 on inquiry card.

INSTRUMENTS ON THE MARCH

New Principles, Applications, Non-commercial Developments

Williams Memory

WASHINGTON, D. C.—SEAC, the National Bureau of Standards Eastern Automatic Computer, has an auxiliary memory of the Williams cathode-ray tube type. Part of the memory's 48 five-inch and three-inch tubes are shown, their faces covered with copper screening and protective plates. In practice, 45 of the tubes are used for storing information, and the remaining three tubes are spares. In this type of memory, information is stored as charged "dots" or "dashes" at a great many positions on the faces of the tubes.


COUNTER
POWER SUPPLY
TO OTHER TUBES
STATICIZER
DEFLECTION GENERATOR
WILLIAMS TUBE
ADDRESS IN
ADDRESS REGISTER
HIGH VOLTAGE SUPPLIES
REGENERATION AMPLIFIER
OPERATIONS GENERATOR
WORDS OUT TO ARITHMETIC CIRCUITS OR OUTPUT
TO & FROM OTHER TUBES
CONTROL DRIVERS
TO & FROM OTHER TUBES
SHIFT REGISTER
SYNCHRONIZER
CONTROL & TIMING PULSES
WORDS IN FROM ARITHMETIC CIRCUITS OR INPUT

Block system of the Williams electrostatic memory that has been added to SEAC is shown, as is a demonstration pattern of dots and dashes on the face of a cathode-ray tube in SEAC's Williams storage system. (Actual Williams tubes have a copper screen across the face; to get a clear picture of the dots and dashes, this picture was taken on a monitor tube connected in parallel with the screened Williams tube.)

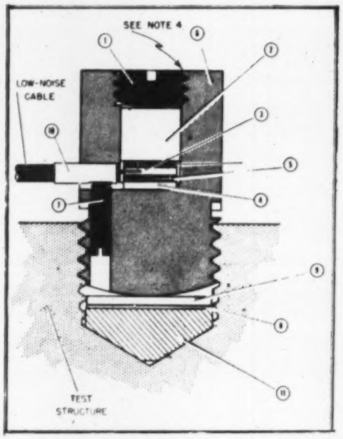
Air Gage Saves Money

LYNN, MASS.—Adaptation of an air inspection gage for dimensional inspection of turbine bucket blades for the J-47 jet engine will save $13,500 annually for the General Electric Company's Accessory Turbine manufacturing plant in Lynn, Mass., according to H. J. Service, Manager-Manufacturing, Accessory Turbine Department.

The device, a Sheffield "Precisionaire," combines a specially adapted thirteen-column air gage with basic gaging elements. It checks thirteen machining dimensions and completes final inspection in one positioning of the bucket. Formerly, six individual gages were required to do this inspection job.

Wide-range Barium-titanate Accelerometer

WASHINGTON, D. C.—A barium-titanate accelerometer with wide frequency and acceleration ranges has been constructed by T. A. Perls and C. W. Kissinger of the National Bureau of Standards. Known as the "NBS-33-14" accelerometer, the device features small size and low mass, uniformity of response, good shielding, low cable noise, and small transverse response. The accelerometer has a range of ± 50,000 *g* and a natural frequency of 90,000 cps.


SEE NOTE 4
①
⑥
②
LOW-NOISE CABLE
③
⑩
⑤
⑦
④
⑨
⑧
TEST STRUCTURE
⑪

The unit, exclusive of cable, weighs only 0.27 ounce, is 0.78-inch high, and has a maximum diameter of 0.58 inch. The ceramic crystals are 0.175 inch in diameter and 0.020-inch thick. They are made of a mixture of 96-percent barium titanate and 4-percent lead titanate. The voltage sensitivity is about 0.7 millivolt per *g* at the end of its 3-foot cable. Preliminary field tests have shown that they can withstand accelerations of the order of 150,000 *g* without damage.

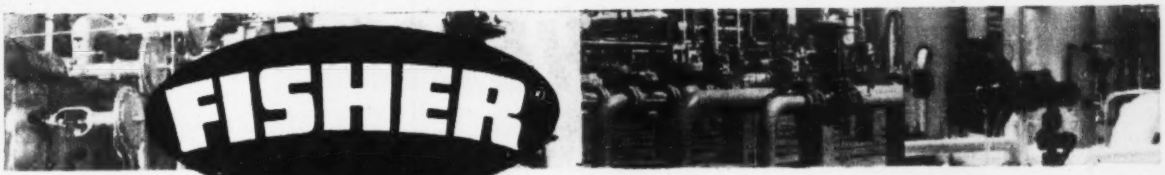
Illustration shows loading mass (2) and barium-titanate crystals (5).

Materials Testing Reactor Available to Public

IDAHO FALLS, IDAHO.—The Atomic Energy Commission announces that it has made available to the public on a limited basis the specialized facilities of the Materials Testing Reactor at the National Reactor Testing Station in Idaho. The MTR, developed and built under the AEC's Reactor Development Division and supervised by the Commission's Idaho Operations Office, is a unique research tool because it is a high-intensity neutron source. It can produce isotopes of higher specific radioactivity than the Argonne, Brookhaven, and Oak Ridge reactors where irradiation services are also performed for the public.

Charges will be made for public irradiations in the MTR. These charges, based on all costs involved, including depreciation, overhead and operating expenses, are considered to be sufficiently low to bring the service within the means of qualified research organizations. Applications should be

Continued on page 1135



Automatic Controllers

WORTH MORE
WHEN YOU
SPECIFY THEM
WORTH MANY
TIMES MORE
IN SERVICE
FISHER

FISHER AUTOMATIC CONTROLLERS give you *more for your money* because they *stay on the job*—minimizing "out-of-service" production expenses that quickly amount to many, many times the cost of the controller.

You actually *save money* when you specify Fisher Pressure Regulators—Pump Governors—Liquid Level Controllers—Pilot Operated Regulators—Lever and Float Valves—Intermitters—Gas Regulators—Valve Positioners.

FISHER GOVERNOR COMPANY • Marshalltown, Iowa

WORLD LEADER IN RESEARCH FOR
BETTER PRESSURE AND LIQUID LEVEL CONTROL

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Since 1880

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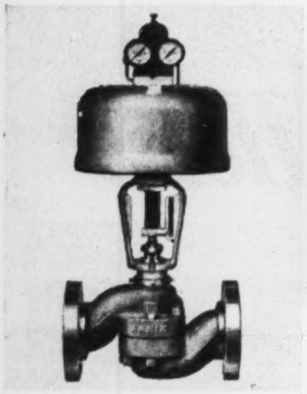
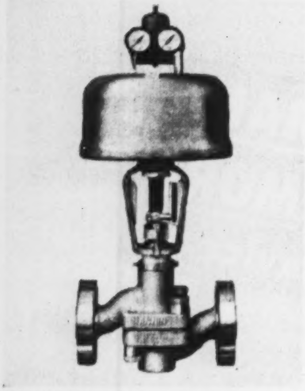
BOOTHS 659 & 661
ISA EXHIBIT
PHILADELPHIA
Sept. 13th thru 24th

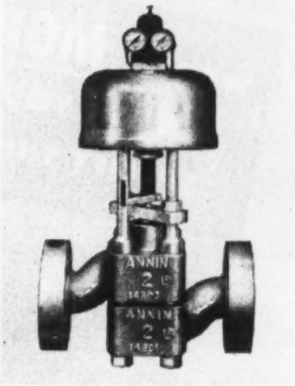


Model 1560

Model 3460

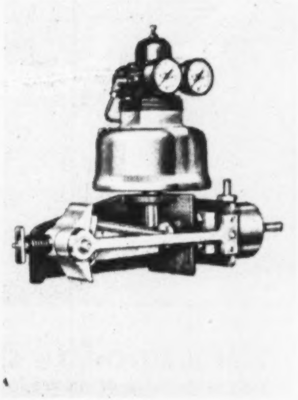


Model 2560



Model 3560

Catalyst Slide Valve



Model 5060

Only

ANNIN SINGLE SEAT DOMOTOR VALVES MEET ALL CONTROL VALVE REQUIREMENTS

SIZES – CV .000001 to 1000

LINE SIZES – ½″ thru 10″

BODY RATINGS – Standard 150, 300, 400, 600, 900, 1500, 2500 PSI. Others to 50,000 PSI.

BODY DESIGN – Globe, angle and three-way. Tight shut-off, single seat body. Free-flowing design eliminates erosion. Doolseal, Bellows seal, cooling fin interchangeable with standard bonnet. Optional Teflon guide bushings and Teflon seat seal.

OPERATORS – Domotor, Cylinder and Handwheel. Precise positioning Domotor operators for all pressures and pressure drops. Stroke ranges .005 to 6 inches. Piston sizes of 25, 50, 100, 200 and 400 sq. ins. for thrusts up to 40,000 lbs.

ANNIN
VALVE

Write today for illustrated catalog 1500B
You'll profit by learning more about the superior features and better performance of Annin Control Valves

ANNIN
Control
VALVES

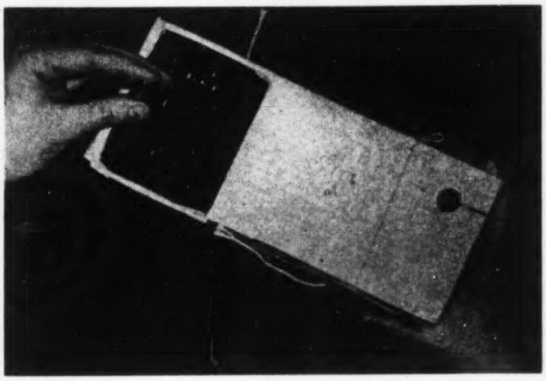
THE ANNIN COMPANY
6570 E. TELEGRAPH ROAD, LOS ANGELES 22, CALIFORNIA

For more information circle **15** on inquiry card.

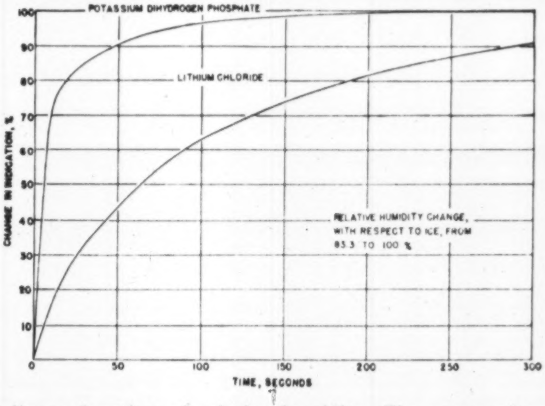
filed with the U. S. Atomic Energy Commission, Isotopes Division, Oak Ridge, Tennessee. The contractor operating the MTR—Phillips Petroleum Co., Idaho Falls, Idaho—should be contacted directly for information concerning technical questions relating to irradiation services, scheduling, price lists, and arrangements for obtaining these services.

Rapid-response Hygrometer

WASHINGTON, D. C.—An improved electric hygrometer of high sensitivity and rapid response has been constructed by Arnold Wexler, Albert Krinsky, and associates of the National Bureau of Standards. The hygrometer now employed in radiosonde flights consists of a flat strip of polystyrene having sputtered tin electrodes on the two long edges and coated with an electrolytic film of aqueous lithium chloride dissolved in a plastic binder. One of the basic limitations of this type of hygrometer is its relatively slow response.



Experiments led to a rapid-response hygrometer consisting of an extremely thin film of a salt, such as potassium dihydrogen phosphate, evaporated under vacuum on a specially treated flat strip of glass or other insulating material. The logarithm of the resistance of the film is essentially a linear function of relative humidity. The range of resistance extends over six decades, decreasing with increasing relative humidity; at low humidities the resistance is of the order of 10^{12} ohms. The problem presented by the high resistance of the film was solved by design of an electrometer-tube circuit which subjects the hygrometer to a maximum current loading of 100 microamperes. The output of this circuit varies linearly with the logarithm of the



Continued on page 1138

Measure . . .
Compare . . .
Correct . . .

MEASURE your entire production output—eliminate doubtful "sampling." The SELECTROL checks *every* unit produced. It automatically weighs, classifies, sorts, and records.

COMPARE every unit produced and learn immediately the range and average of units *as they are produced.* The Average and Range Control Plotter records each production unit as it flows over the SELECTROL.

CORRECT your filling machine settings. Eliminate your assignable causes rapidly.

The SELECTROL Automatic Checkweighing Machine is designed for direct insertion into your production line. It's a time-proven production machine in use on hundreds of industrial production lines. Send coupon today for complete details.

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Exact Weight *Scales*
Better quality control
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THE EXACT WEIGHT SCALE COMPANY

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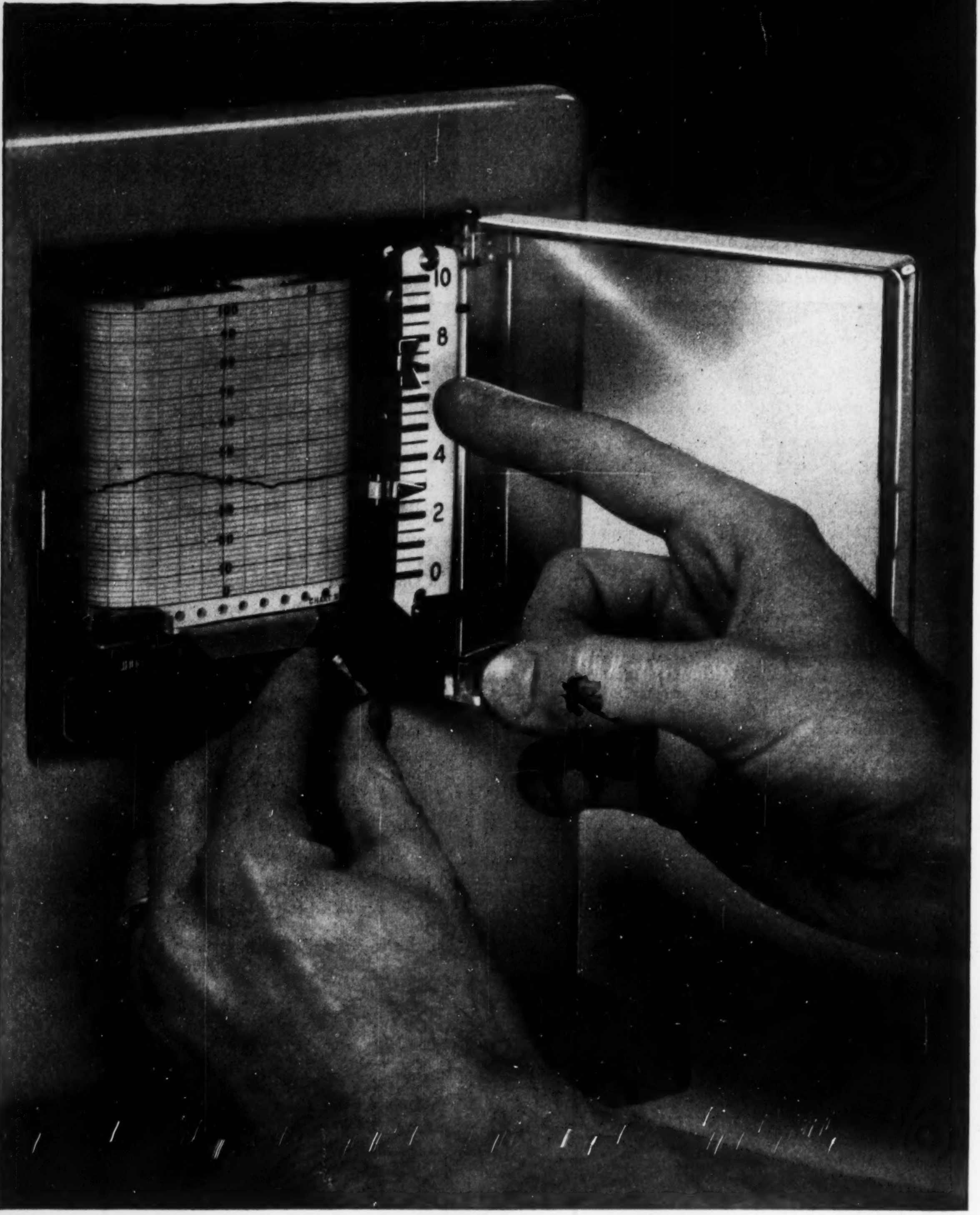
For more information circle **16** on inquiry card.

. . . WHAT'S NEW AT BRISTOL . . .



BRISTOL'S "HUMAN-ENGINEERED" METAGRAPHIC RECORDER, with its easy-to-read scale, high-visibility fluorescent pointers and shadow-proof door has earned a reputation as the "biggest miniature in the industry". There's no switching necessary to get a reading of the control valve position. The continuous valve-position indication, separate from set-point indication, gives continuous data on control valve position and process level. The high-precision, two-stage, no-drift set-point regulator has high-capacity (3 scfm) output for fast manual control in emergencies.

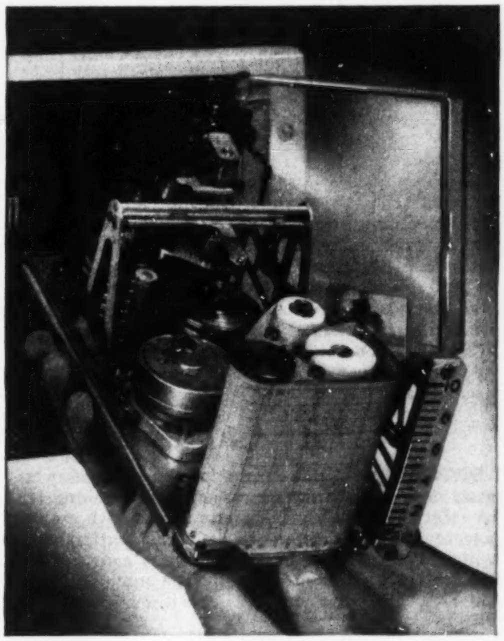
For more information circle **17** on inquiry card.

Instrument men call Bristol's METAGRAPHIC Recorder

"... the biggest little instrument in the industry"

Sounds contradictory, but it's true. Take a look at one of our new METAGRAPHICS mounted on a panel board alongside of other instruments. The Bristol unit stands out — seems bigger than the rest — although chances are it's actually smaller (5″x5¼″). The answer is that the Bristol instruments have been *"human-engineered"*, making them easy to read, and clearly visible at greater distances.

To meet the increasing need for miniature instruments, we didn't simply scale down one of our larger recorders, we designed a completely new unit, creating a smaller instrument with all the advantages of the large one. In other words, the new METAGRAPHIC is a "big" little recorder.



TRUE PLUG-IN SERVICE is a big advantage to the operating man. If trouble is suspected in an instrument, the doubtful unit can be removed and a spare plugged in in a matter of seconds, with no interruption in the process operation, no loss of air, no loss of control.

"Human-engineered" METAGRAPHIC records pressure, temperature, vacuum, flow, differential pressure, and liquid level

Here are some of the advantages of the air-operated Metagraphic Recorders:

SIMPLICITY . . . fewer moving parts, fewer adjustments, and less service required. Range changes can be made in seconds.

CONTINUOUS VALVE-POSITION INDICATION . . . on same instrument scale as set-point scale, gives continuous data on control valve position—makes "bumpless" transfer possible simply by matching pointer positions — no need to read actual scale values — minimizes reading errors — speeds operations.

TRUE PLUG-IN SERVICE . . . provides great savings in installation costs. Cases can be ordered and installed before selecting range and type of control. Instruments can be plugged in later or interchanged at will. This adds up to a big advantage to the process design engineer — he doesn't need to make decisions during the design stage that can't be easily changed later.

CONTINUOUS OPERATION . . . complete unit can be retracted for inking pen, and for set-point and zero adjustment without disturbing record or control.

Get the whole story on the "human-engineered" METAGRAPHICS — how they can help you get more accurate measurements, faster and easier. Write us today. The Bristol Company, 113 Bristol Road, Waterbury 20, Conn.

6.4.3R

BRISTOL

POINTS THE WAY IN HUMAN-ENGINEERED INSTRUMENTATION

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

For more information circle **17** on inquiry card.

How
to keep
air-operated
instruments
healthy

When air-operated instruments breathe dirty air, they soon get clogged up, lose their accuracy and eventually wind up in the repair shop.

● But moisture, dirt or oil can't harm your instruments if you install a Cuno MICRO-KLEAN filter in your air line.

MICRO-KLEAN's double-capacity cartridge positively removes *all* entrained moisture together with foreign particles down to one micron in size.

One of the most attractive things about MICRO-KLEAN is its price. You can get this modern micronic filter (Model 1C1G) for only $5.45—a very small "premium" to insure your instrument investment. This model has 3/8" inlet and outlet pipe size, 125 PSI maximum operating pressure and flow capacity of 15 CFM (free air).

It'll pay you to clip the coupon and send it off today.

Cuno Engineering Corporation
Dept. 3817M South Vine Street, Meriden, Connecticut

☐ Please send me a Cuno MICRO-KLEAN Model ICIG filter for air-operated instrument protection. Bill me $5.45.

☐ I'd like some more information about MICRO-KLEAN. Send me your free MICRO-KLEAN Air Line Filter Bulletin.

Name....................................
Company....................................
Address....................................
City......................Zone....State........

M.3.17

CUNO ENGINEERED FILTRATION

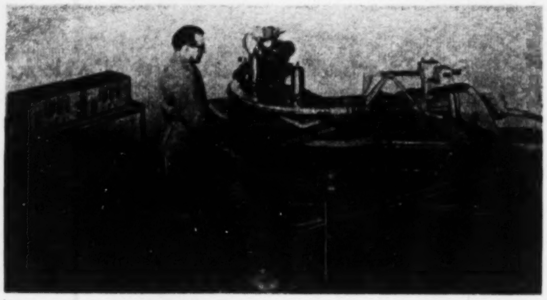
For more information circle 18 on inquiry card.

input resistance; the result is an output approximately linear with relative humidity.

On this hygrometer, a 63-percent change in indication, caused by a sudden change in relative humidity, takes place in less than ½ second at room temperature.

Stretch-wrap Forming

EL SEGUNDO, CALIF.—The Hufford Machine Works of El Segundo uses electronic counters to overcome effect of material hardness variations in stretch-wrap forming operations. In the past, the amount of stretch was controlled by the pressure exerted; hence a different stretch resulted each time the material hardness varied. Now, however, the lineal change is measured directly and greater pressures can be applied.

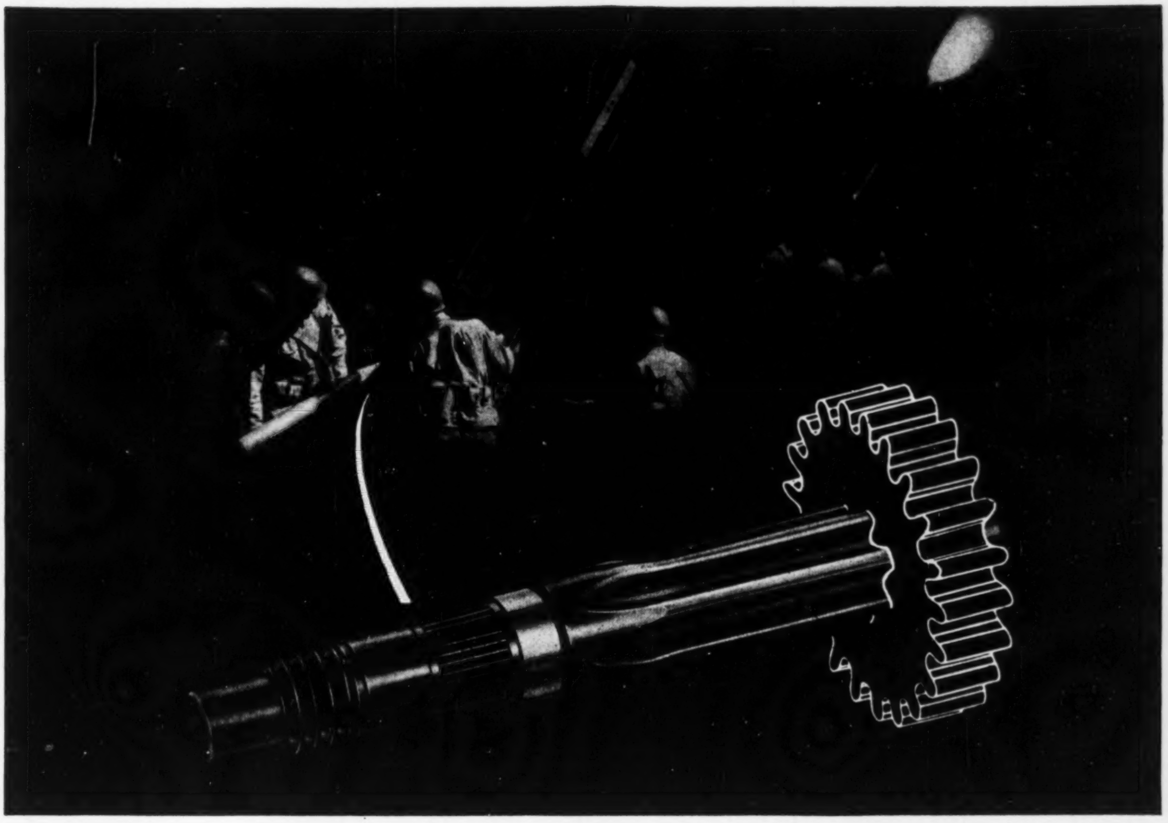


The mechanism employs two electronic counters. Attached to each tension cylinder of the Model A-5 Hufford Stretch-Wrap Forming Machine illustrated is a mechanical device which measures jaw retraction. This consists of a disc marked with a series of alternate black and white lines radiating from the center. The disc is rotated by contact with the sliding arm attached to the jaw. Each 1/10th inch of ram travel causes one white line on the disc to pass an aperture. A light beam reflected by each white line is picked up by a photocell and converted to an electrical impulse. Thus a series of electric impulses is transmitted from each arm to its respective electronic counter. The desired stretch is "punched" on the electronic counter keyboards in inches and tenths. When this total is counted off, the stretch is automatically halted.

Lift Capacity

DETROIT, MICH.—A new means of quickly and accurately checking the lifting capacity of wrecking trucks and the safety factor of winches and booms with a Dillon dynamometer has been found to be highly satisfactory by the Ashton Power Wrecker Equipment Company of Detroit. The test is used on all new models manufactured by this company. The dynamometer is positioned in series between

Continued on page 1142



What has an ack-ack shell fuze to do with your present problem?

Plenty...as you'll see

You'll find this "flash channel" in time-and-point detonated shell fuzes that make our antiaircraft guns deadly to enemy planes.

The channel is Superior tubing—lead-pencil size. Along it races the flash-through—from point detonator to main powder charge—that explodes the shell on impact. The same tubing serves as a pinion in the gear train of a mechanical detonator, which explodes the shell at a set altitude. Result: double deadliness for ack-ack.

What about your problems? Wait just a moment . . .

Trouble was that flash-through must travel a perfectly straight path to prevent misfires. Ordnance had the dickens' own time with this problem. Flash channels of drilled bar stock proved untrustworthy. And it wasn't until Ordnance called on Superior that the puzzle was licked. A special grade of heavy wall Superior tubing—precision drawn Type C1118 carbon steel—proved perfect for the multiple close-tolerance machining needed to make the fuze part.

Now! You may need tubing made with the same accuracy essential in flash channels. And much of it may require special dimensions, shapes, even analyses. Superior makes a specialty of such special tubing. For example, you'll encounter Superior tubing in hypodermic needles, heat exchanger coils, truck wheel bushings, jet-engine ignition harness, and electronic parts of many kinds.

Superior will be happy to work with you in developing, designing and producing the tubing you need. If you have a problem involving tubing, get in touch with us. Write for a FREE copy of Superior's 40 page Carbon and Alloy Steel Catalog and more information on special tubing. Superior Tube Company, 1968 Germantown Ave., Norristown, Pa.

Round and shaped tubing available in Carbon, Alloy and Stainless Steels; Nickel and Nickel Alloys; Beryllium Copper; Titanium; Zirconium

Superior Tube

THE BIG NAME IN SMALL TUBING

All analyses .010" to ⅝" O.D.

Certain analyses in light walls up to 2½" O.D.

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For more information circle **19** on inquiry card.

Arthur Marquis
Design and Application Engineer

Arthur R. Kozlowski
Design and Application Engineer

John H. Smedley
Design and Application Engineer

George D. Barcus
Design Engineer

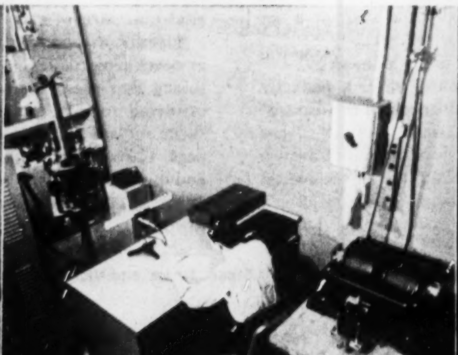
Rollin J. Parker
Supervisor—Magnetic Products Design and Application

These Carboloy® permanent

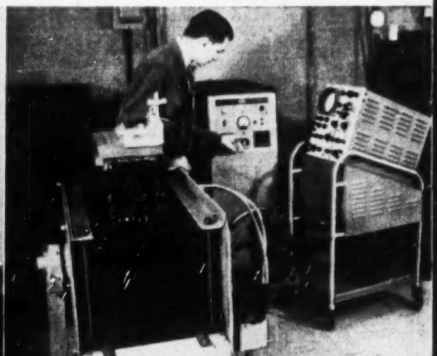
At the modern Carboloy magnet laboratory, in Detroit, trained engineers work with the finest equipment. Where necessary, special instruments are often designed by the engineers.

With such complete facilities, Carboloy magnet engineers can give you accurate information, quickly. And, they can thoroughly test their designs and the performance of the magnets in your products.

DC Recording Hysteresigraph. Simultaneously plots magnetic force and resulting magnetic induction. Produces complete hysteresis loops, not ordinary point-by-point readings.



High H-Permeameter. Provides point-by-point readings of magnetizing force and induction. Control table and Ballistic Galvanometer also used for general flux measurements.



Condenser Discharge Magnetizer. Produces very large current impulse for magnetizing magnet configurations that can best be accomplished with special field shapes.

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Mgr.—Design and Application Engineering

Robert J. Studders
Supervisor—Magnetic Materials and Process Development

Edgar W. Engle
Mgr.—Product and Process Development Engineering

Edgar L. Hubbard
Sales Mgr.—Permanent Magnets

magnet engineers can help improve products, cut costs

Experienced magnet engineers, using the latest test and development equipment, will provide complete engineering appraisal service

You can get valuable technical assistance, without obligation, on the design and application of permanent magnets, from Carboloy magnet engineers . . . men who are leaders in the field.

Only at the Carboloy Department can you obtain engineering appraisal service and sample magnets from separate laboratory facilities devoted exclusively to helping you determine the design and optimum size, shape and strength magnets to fit your particular application. Your product will be tested in the modern Carboloy magnet laboratories, on the latest test instruments, to assure the maximum operating efficiency of the magnets.

PROVED RESULTS

The assistance Carboloy engineers have given other designers and manufacturers has paid off time and again in lower production costs, improved product efficiency, simplified assemblies and reduced product size.

You can rely on their solutions because these engineers, many of whom worked on the original development of Alnico, are specially trained and experienced in all phases of permanent magnet design and application.

You can depend on Carboloy magnet sales engineers, too, for authoritative and intelligent answers to your questions. These men have intensive, special training in permanent magnets, supporting their engineering and technical backgrounds.

A COMPLETE SERVICE

Together with the engineers who are working on the development of new magnetic materials and on the improvement of existing Alnico grades, *these men make a complete permanent magnet team.* Their sole job is to help you utilize the tremendous potential of permanent magnets for new and improved products.

This team can start working for you, today. Just fill out the coupon and attach to it your company letterhead, and where possible, blueprints or sketches of the job. Or, if you prefer, the coupon will bring a call by your local Carboloy magnet sales engineer.

Three typical, successful appraisal projects:

INSTRUMENTS. Working with Thomas A. Edison, Inc., Carboloy engineers provided the magnet design that made possible a revolutionary fire detection relay. Use of the proper magnets simplified the design of the relay and reduced its size and weight.

CONTROLS. The development of the hysteresis brake was pioneered by Carboloy magnet engineers. Now widely used in the textile and wire rope industries, this brake eliminates friction, while maintaining the necessary constant tension.

TELEVISION. Carboloy magnet engineers collaborated with tube engineers on the design of a new magnetic internal focusing device. They designed the smaller, more efficient magnets that helped eliminate focusing dials and external assemblies.

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DEPARTMENT OF GENERAL ELECTRIC COMPANY
"Carboloy" is the trademark for products of the Carboloy Department of General Electric Company

CARBOLOY
Department of General Electric Company
11155 E. 8 Mile Street, Detroit 32, Michigan

☐ I would like magnet engineering assistance; I am enclosing necessary information and blueprints.

☐ Have a Carboloy magnet salesman call.

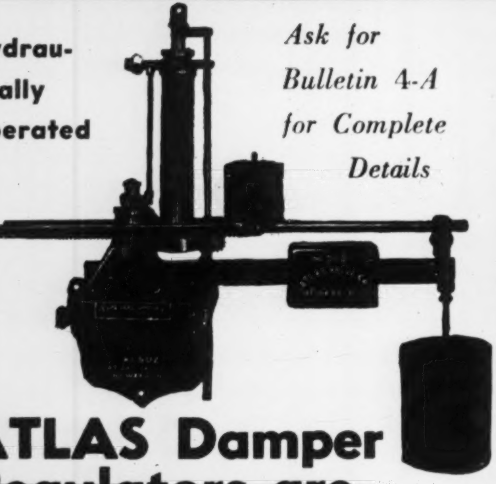
Name ____________________ Position ____________

Company ______________________________

Address ______________________________

City ____________________ Zone ____ State ________

For more information circle **20** on inquiry card.



ATLAS

Hydraulically Operated

Ask for Bulletin 4-A for Complete Details

ATLAS Damper Regulators are made for all boiler room conditions. They do this:

1—Continuously maintain the desired pressure in steam boilers by automatically adjusting the boiler drafts or dampers.
2—On forced draft boilers they may be arranged to control the speed of the fan.
3—They may be made to regulate the rate of feed of stokers on stoker fired boilers.
4—By regulating the draft they reduce the amount of air used to the desired minimum.
5—With air volume minimized a higher and more efficient temperature is attained and maintained.
6—CO_2 is kept where it should be and CO is avoided.
7—Much fuel is saved by reducing the volume of air used, eliminating CO, and keeping the chimney gas temperature down where it belongs.
8—They save labor. Without an ATLAS it is necessary to regulate boilers "by hand". Hand regulation costs much more, and, even when watched *constantly* gives a lower boiler efficiency than ATLAS control.
9—ATLAS damper regulators quickly pay for themselves. Installed on almost any boiler they are an important economy factor.

Other ATLAS products: CAMPBELL Boiler Feed Regulators; Temperature Regulators; Reducing Valves; Exhaust Control Systems; Pressure Regulators; Pump Governors; Back Pressure Valves; Balanced Valves; Control Valves; Float Valves; Etc.

ATLAS VALVE COMPANY
REGULATING VALVES FOR EVERY SERVICE
292 South St. Newark 5, N. J.
Represented in Principal Cities

For more Information circle 21 on inquiry card.

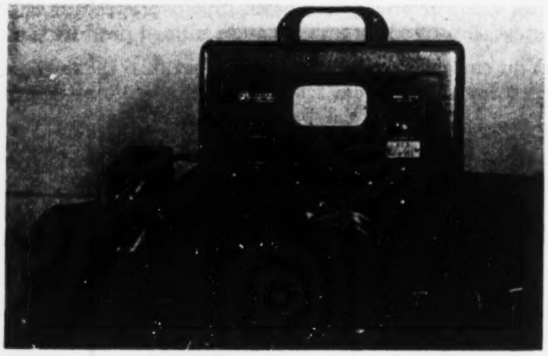
a heavy semi-trailer and the wrecker, and the load is applied through a winch. This test will also serve as a means of inexpensively checking trailer and truck weights at points where no platform scales are available.

X-ray Diffraction Course

MILWAUKEE, WIS.—More than 50 users of X-ray diffraction equipment for industrial product improvement and quality control gathered at the Milwaukee headquarters of General Electric Co., X-Ray Department, the week of March 22 for a concentrated refresher course on this subject. Laboratory sessions were a vital part of the School on X-Ray Diffraction. Left to right are Joseph Ranftl, General Electric; Corienne Butt, diffraction assistant, Ladish Company, Cudahy, Wis.; Dr. David Harker, director, Protein Structure Project, Brooklyn Polytechnic Institute; Wallace Benson, chemical engineer, The Limex Corp., Indianapolis, Ind.; and William Whitney, petrographer, Ideal Cement Co., Ft. Collins, Colo.

Automatic Monitor

IDAHO FALLS, IDAHO.—Occasionally, film badge containers and pocket ionization chambers used in personnel monitoring became contaminated on the outside with radioactive matter. The Health and Safety Branch of the Atomic Energy Commission's Idaho Operations Office has developed the device shown above to automatically monitor the containers and chambers. The machine employs a belt conveyor which mechanically moves the equipment to be checked between two ordinary Geiger-Mueller tubes. These tubes are attached to a Nuclear Instrument and Chemical Co. ratemeter. The device normally shuts itself off if the count rate exceeds 200 counts per minute. (A 0.2-mr. source gives about 4000 counts per minute, so minor contamination will stop the conveyor.) The device handles 40 badges or 50 pocket ionization chambers per minute.



TO MANAGEMENT...
PANELLIT INFORMATION SYSTEMS
OFFER COMPLETE **CONTROL**

PANELLIT has designed and built Automatic Control and Information Systems for the complete control of processes since 1943. Whether you are in a fabricating or a processing industry, Panellit alone offers:

- Basic System Design and Engineering
- *Impartial* selection of instruments and components
- Assembly and Fabrication of *complete* systems
- *Panalarm*—Integrated Alarms for Safety
- *Panascan*—Scanning, Data-Processing and Data-Reduction systems
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PANALARM
Alarm and Safety Division

PANASCAN
Scanning and Data-Reduction Division

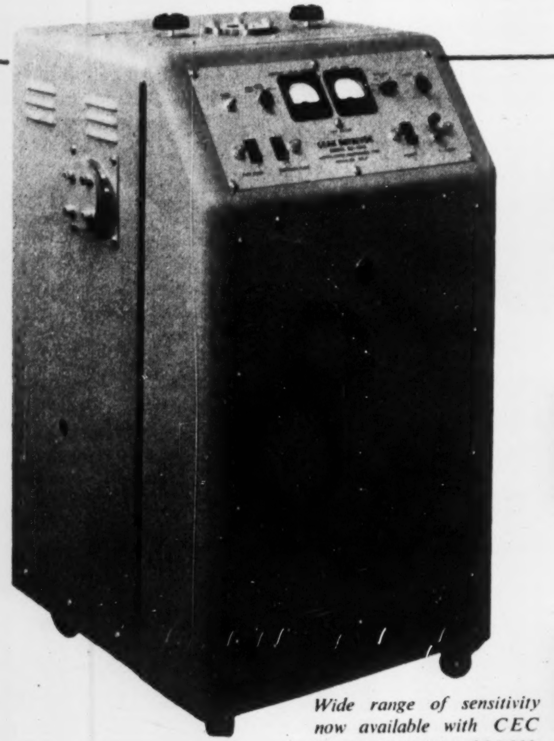
For more information circle **22** on inquiry card.

Sensitive to *1 part in 2,000,000*

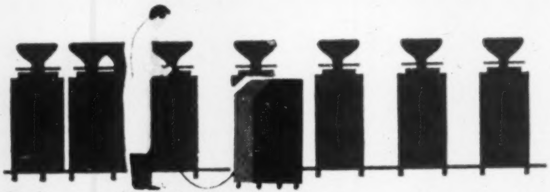
Consolidated's new Model 24-110 *Leak Detector*

For leak detection applications where the utmost in sensitivity is required, Consolidated's new Model 24-110 Leak Detector meets the most stringent requirements. The latest addition to the Consolidated leak detector line is a modification of a high precision instrument built by CEC for the Atomic Energy Commission. Operating on the mass spectrometer principle made famous by CEC's widely used Model 24-101A industrial leak detector, the sensitivity of the 24-110 has been multiplied by a factor of 10 through advanced electronic techniques. Its uses include testing of both evacuated and pressurized equipment, revealing the existence or the absence of leaks, finding the locations of leaks, and determining the rates of leakage. Outstanding features include: an audible alarm whose sound-pitch varies with the magnitude of the leak; an accessory sampling probe for rapid pressure-system leak testing; a selector switch that provides six ranges of sensitivity; a visual leak-rate meter capable of indicating the presence of 1 part helium in 2,000,000 parts air. Compact, self-contained and mobile, Consolidated's new Model 24-110 Leak Detector is a perfect tool for highly critical applications such as detection in ultra high vacuum laboratory equipment, leak-checking of TV color tubes, and safety control in nuclear material manufacturing.

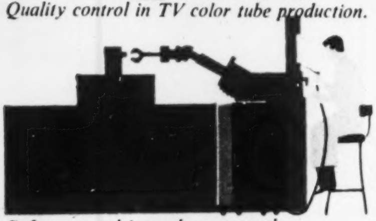
Request Bulletin CEC 1838-X4



Wide range of sensitivity now available with CEC Models 24-101A and 24-110.



Quality control in TV color tube production.



Safety control in nuclear research.

Leak detection for ultra-high vacuum equipment.

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CORPORATION
300 North Sierra Madre Villa, Pasadena 15, California

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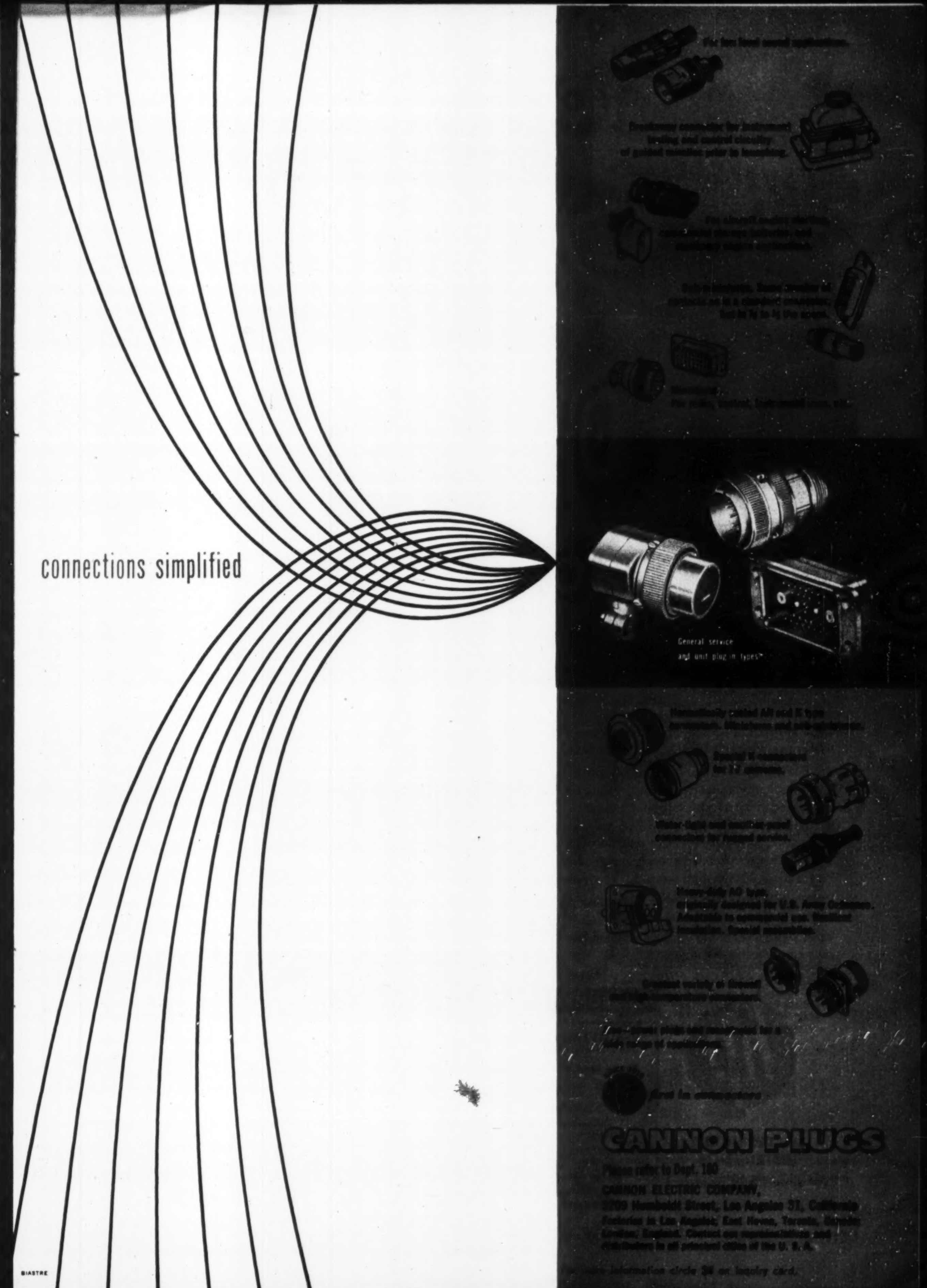

connections simplified

For low level sound applications.

Breakaway connector for instrument
testing and control circuitry
of guided missiles prior to launching.

For aircraft engine starting,
commercial storage batteries, and
stationary engine applications.

Sub-miniatures. Same number of
contacts as in a standard connector,
but in ¼ to ½ the space.

Miniatures.
For radio, control, instrument uses, etc.

General service
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Hermetically sealed AN and K type
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Special K connectors
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Water-tight and weather-proof
connectors for rugged service.

Heavy-duty AO type,
originally designed for U.S. Army Ordnance.
Adaptable to commercial use. Resilient
insulation. Special accessories.

Greatest variety of firewall
and high-temperature connectors.

Low-power plugs and receptacles for a
wide range of applications.

first in connectors

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Factories in Los Angeles, East Haven, Toronto, Canada;
London, England. Contact our representatives and
distributors in all principal cities of the U. S. A.

more information circle 38 on inquiry card.

BIASTRE

Complete Coverage!

10 cps to 4 mc

-hp- 400D

VACUUM TUBE VOLTMETER

Accurate within 2% to 1 mc

Measures 0.1 millivolt to 300 volts

Reads dbm direct

High sensitivity, stability, input impedance

Light, small, portable, dependable

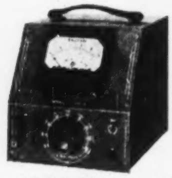
-hp- 400D combines new features never before found in one voltmeter, with time-tested conveniences of the famous *-hp-* 400C.

Frequency coverage is extremely broad—10 cps to 4 mc. A new amplifier provides 56 db of feedback (mid-range) for highest stability and freedom from change by external causes. Input impedance is 10 megohms so circuits under test are not loaded. Coupling and by-pass condensers are sealed; electrolytic condensers are long-life type. Construction is highest quality throughout; circuitry is clean, easy to reach. New compact metal case simplifies handling, occupies less bench space. Front tilts upward for convenient reading angle.

Use the new *–hp–* 400D for measuring amplifier gain, network response, output level, hum and noise, power circuit, broadcast high frequency voltages, as an audio level meter, high gain broad band amplifier, null detector, waveform monitor, and coil "Q" meter. $225.00.

–*hp*– 410B Vacuum Tube Voltmeter

Wide range, flat response ± 1 db, 20 cps to 700 mc. Small, convenient, simple to use. Diode probe places approximately 1.5 μμfd capacity across circuit under test. This plus 10 megohms shunt impedance (high frequency) means circuits are not disturbed, and true voltage reading are assured. Also measures dc voltage to 1,000 volts and resistances to 500 megohms. $245.00.



–*hp*– 400A Vacuum Tube Voltmeter

Direct voltage readings between 10 cps and 1 mc. 30 millivolts sensitivity full scale; accuracy is ± 3% to 100 kc, ± 5% to 1 mc. Voltage range .005 to 300 volts. Input impedance 1 megohm shunted by 25 μμfd. $185.00.

–*hp*– 400B Vacuum Tube Voltmeter

For measurements 2 cps to 100 kc. Sensitivity 30 millivolts full scale. Measures voltage .005 to 300 volts, input impedance 9 megohms shunted by 25 μμfd. Accuracy ± 3% to 100 kc. Usable as stabilized amplifier. $195.00.

–*hp*– 404A Battery-Operated Voltmeter

For general voltage measurements where ac power is not available. Compact, portable, splash-proof, ruggedly built. 2 cps to 50 kc, .0005 to 300 volts, impedance 10 megohms with 20 μμfd shunt. Ideal for remote broadcast, carrier, strain gauge, telemetering, geophysical work; completely hum free measurements. $185.00.

hp

ELECTRONIC TEST INSTRUMENTS

for speed and accuracy

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☐ 400D ☐ 400A ☐ 400B ☐ 410B ☐ 404A

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Company____________________________

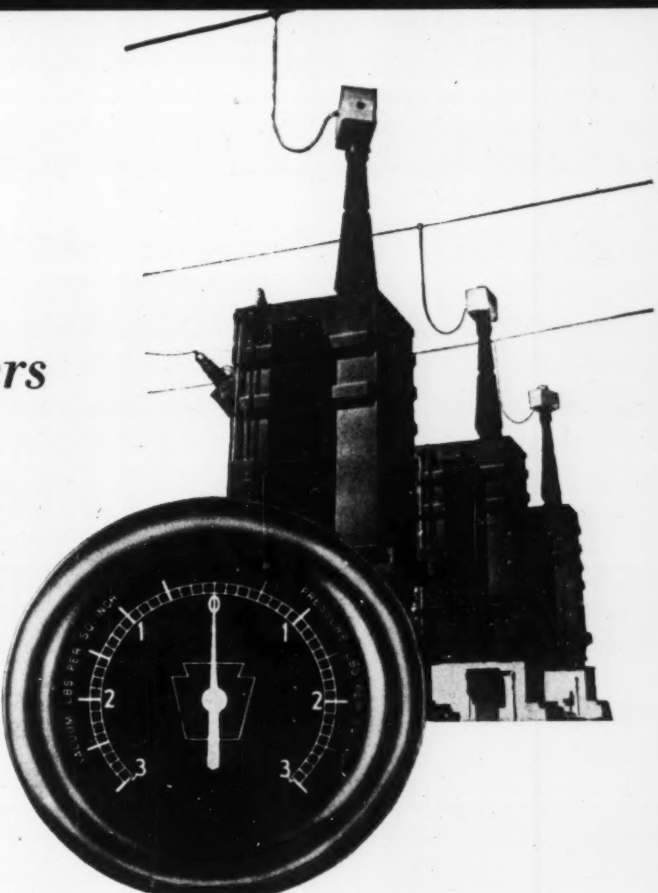
Street_____________________________

City________________Zone_____State_______

Data subject to change without notice. Prices f.o.b. factory.

For more information circle **25** on inquiry card.

How to tell when transformers suffer from high or low blood pressure



USG creative instrumentation produced this exclusive 3½" oil-filled Transformer Gauge shown above. Oil dampens vibration, permits direct attachment of gauge to transformer. Case actually "breathes", eliminating "barometer effect".

Transformers are sensitive to temperature changes. The load on transformers of the inert-air or gas filled types increases or decreases with the ambient temperature. This could lead to trouble if no visual or aural danger signal were given.

US Gauge studied the need and came up with two solutions—two USG Transformer Gauges. One solution—the USG oil-filled transformer gauge, is so constructed that oil dampens vibration from the transformer making it possible to mount the gauge directly upon the transformer. Vibration which might cause an ordinary compound gauge to fail will not affect this instrument.

The other answer—the USG Transformer Compound Alarm Gauge is capable of being hooked up to any of the warning signals currently available. It provides unusually accurate indication and low switching differentials for a gauge with such low pressure limits.

If you are interested in the health of your transformer, you will want us to forward full details on these Transformer Alarm Gauges. If, however, you are more interested in the way USG approaches an instrumentation problem—your problem—get in touch with United States Gauge, Division of American Machine and Metals, Inc., Sellersville, Pennsylvania, and let our Engineering and Production "know how" assist you.

0
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1
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-
+
POUNDS PER SQ INCH

You are looking at the USG 3½" Transformer Alarm Gauge. Note the easily-readable dial and connections for hooking in a signalling system. Separate diaphragms for operating pointer and switches eliminate friction errors.

Quality Gauges Engineered for Enduring Accuracy

UNITED STATES GAUGE

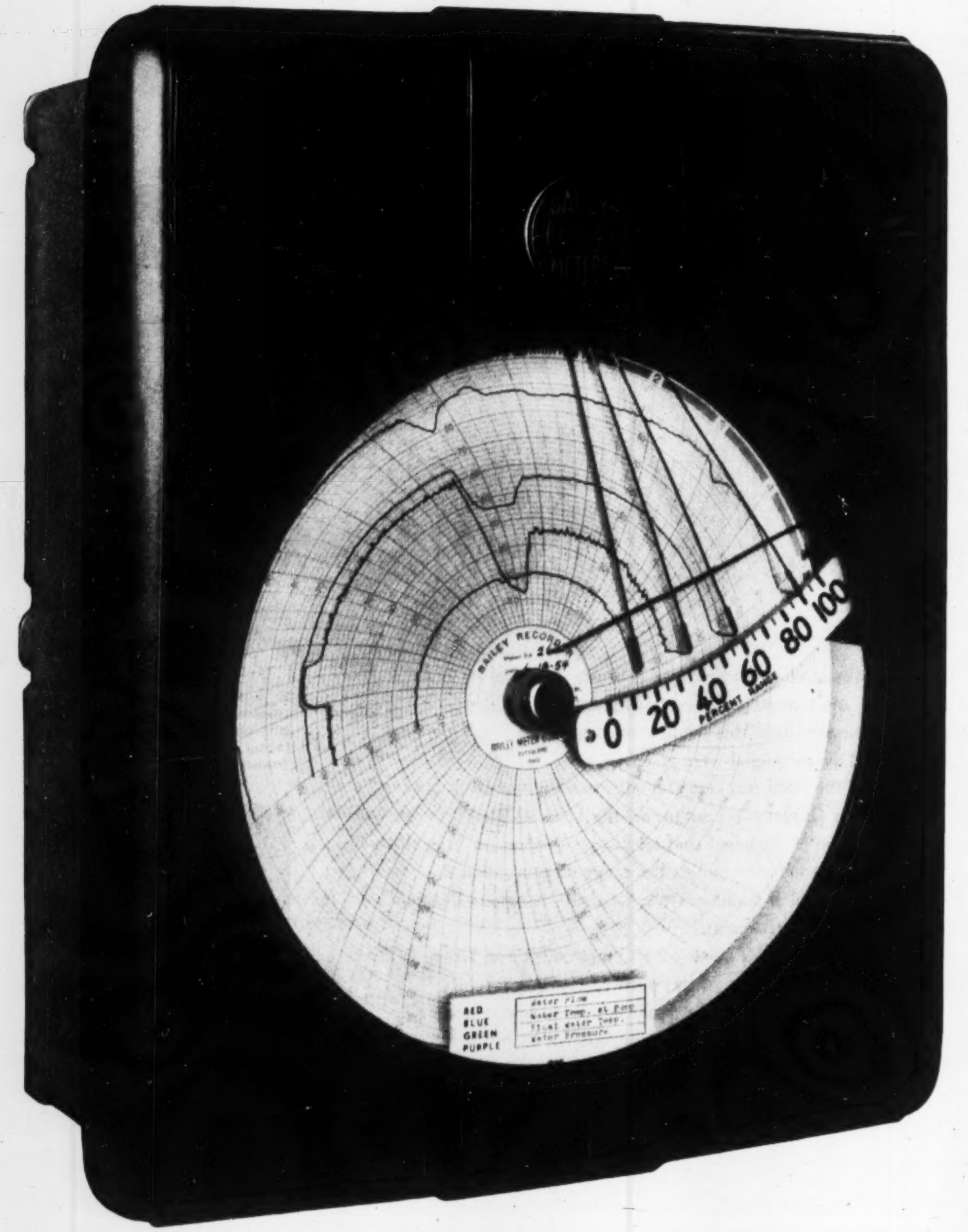
USG

PRODUCTS OF UNITED STATES GAUGE ... Absolute Pressure Gauges • Aircraft Instruments • Air Volume Controls • Altitude Gauges • Boiler Gauges Chemical Gauges • Mercury, Gas, and Vapor Dial Thermometers • Glass Tube and Industrial Thermometers • Flow Meters • Inspectors' Test Gauges Precision Laboratory Test Gauges • Marine, Ship and Air-Brake Gauges • Voltmeters • Ammeters • Welding Gauges.

OTHER DIVISIONS OF AMERICAN MACHINE AND METALS, INC. AT SELLERSVILLE, PA.: GOTHAM INSTRUMENTS, AND AUTOBAR SYSTEMS

For more information circle **26** on inquiry card.

Announcing the New Bailey

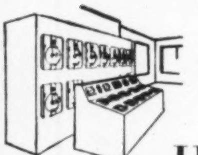

BAILEY RECORDER
0 20 40 60 80 100
PERCENT RANGE
RED
BLUE
GREEN
PURPLE
Water Flow
Water Temp. at Pump
Water Pressure

The New Bailey Recorder provides continuous chart records of any four measured variables:

- % combustibles
- combustion
- conductivity
- density
- differential
- draft
- flow
- liquid level
- % oxygen
- pH
- position
- pressure
- ratio
- smoke density
- specific gravity
- speed
- temperature
- vacuum

For more information circle **27** on inquiry card.

Recorder for—



Pneumatic and Electric Transmission Systems

Here is a panel-mounted recorder that offers new versatility never before available in a single instrument. Its unique interchangeable-unit design permits recording up to four measured variables, regardless of their nature or the location at which they are measured.

Individual plug-in type pneumatic or electronic receivers—and corresponding integrators—are interchangeable in the four identical frame-slots, permitting any combination of four pneumatic or electronic signal receivers, *or any two receivers and their two integrators.*

For the first time you can record four telemetered measurements on a single 12-inch circular chart—with a minimum of first cost and installation expense, and a maximum of operating economy. Low cost multi-purpose components permit fast and easy adaptation to new or changed process cycles.

Visit the Bailey Booth at the Instrument Show
Check These Outstanding Advantages

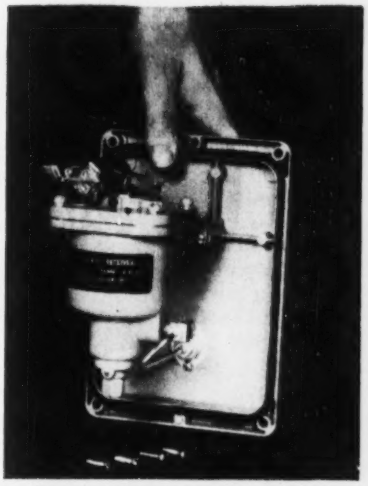
Extreme Flexibility of Application is provided through the use of pre-calibrated plug-in type units—pneumatic or electronic—to record any measurable variables, in any combination. For example, you can "plug-in" pneumatic receivers along with electronic receivers to record up to a total of four variables on the same chart. Or your recorder casing can accommodate two integrators and their two corresponding recording receivers for rate of flow.

Faster, Easier Servicing of instruments is possible because of the new, sealed ink sacs and capillary pens. Under normal conditions ink sacs need be replaced only once each year. There is no day-to-day inking of pens.

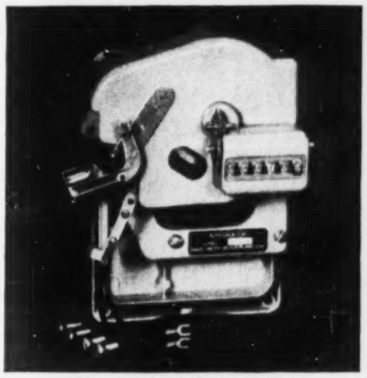
Faster, Easier Ordering from Stock results from the unique standardized unit design. You can select any combination of recording receivers to fit your needs, by reference to simplified catalog specifications, and receive shipment without the delays ordinarily resulting from custom assembly. Complete interchangeability of plug-in type components simplifies stocking of spare units.

G34-2

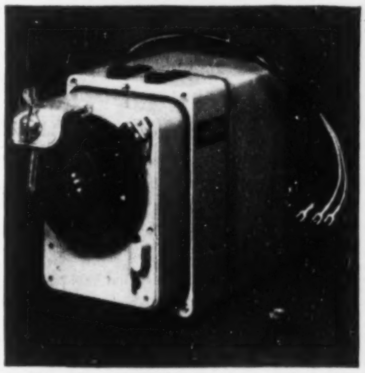
Write for complete specifications—use handy coupon below



Plug-in type pneumatic receiver



Plug-in type integrator



Plug-in type electronic receiver

BAILEY
METER COMPANY
1041 IVANHOE ROAD
CLEVELAND 10, OHIO
Controls for Power and Process

BAILEY METERS

COMBUSTION
TEMPERATURE
PRESSURE
GAS ANALYSIS
LEVEL
RATIO
FLOW

Bailey Meter Company
1041 Ivanhoe Rd., Cleveland 10, Ohio

Please send me product specifications on the new Bailey Recorder, as follows:

☐ With Pneumatic Receivers—Spec. P11-5
☐ With Electronic and Pneumatic Receivers —Spec. E12-5

Name__________
Title__________
Company__________
Street and Number__________
City__________ Zone_____ State__________

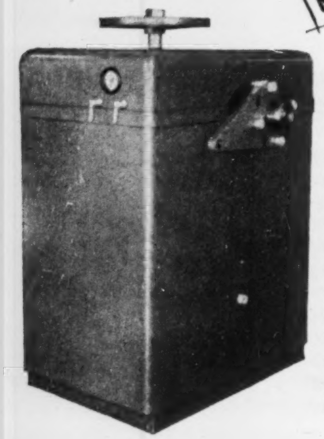
For more information circle **27** on inquiry card.

See the Latest in

Republic

Instruments and

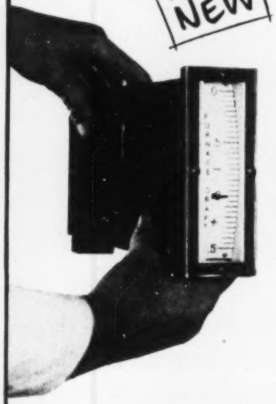
NEW



HIGH TORQUE CONTROL DRIVE

This new Republic Positioner is capable of exerting starting torque in excess of 4,000 lb. ft. It can be furnished for either electronic or pneumatic control systems and is suitable for out-of-doors installation. Rotary shaft output simplifies linkage connections; air failure lock may be remotely reset. Also has positive local hand operating mechanism.

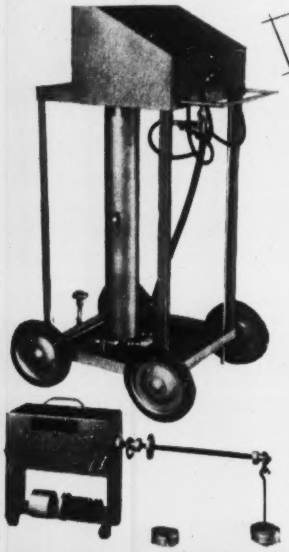
NEW



BANTAM DRAFT GAUGE AND PNEUMATIC RECEIVER

5-inch illuminated scale brings designers of compact control panels all the advantages of small size *without* reading difficulties common to smaller gauges. Available with full sized diaphragms or bellows as a complete differential-type gauge or with bellows for receiving all standard pneumatic pressures. Receiver also available with duplex units and two pointers for indicating steam-flow, air flow or fuel-air on a single scale.

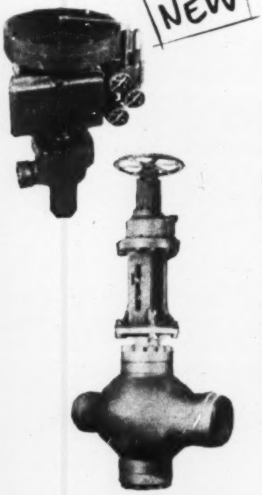
NEW



PORTABLE PNEUMATIC INSTRUMENT CALIBRATORS

Quickly and accurately produces air pressures for faster testing and calibration of instruments. Portability features often allows calibration without removing instruments from their mounting. Linear output of calibrators permits almost any pressure within range to be accurately produced by proper selection of gram weights. Low pressure model is mounted on wheels for easy movement, produces any pressure or vacuum between 0-20-inch water. Smaller medium pressure model (ready for carrying, it's about the size of a carton of soft drinks) has range of 20-inch water to 25 psi.

NEW



CONTROL VALVES

Diaphragm operated modulating valve (left) has been developed especially for pump recirculation control and other high pressure applications. Other Republic valves are available with either flanged or welding ends and lever, cylinder, hand or diaphragm topwork. All are built in accordance with A. S. A. Standards for pressures to 2500 psi. Special body design sharply reduces erosion and noise on severe applications.

REPUBLIC FLOW METERS CO.

For more information circle **28** on inquiry card.

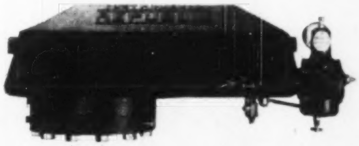
Controls

VISIT
BOOTH
452-8

INTERNATIONAL
INSTRUMENT
EXPOSITION
at
PHILADELPHIA

SEPT. 13 to 24

PNEUMATIC TRANSMITTERS



Here's the transmitter that operating changes can't obsolete. Exceptionally wide range change with minimum change of parts allows you to convert Republic transmitters for other applications, other ranges. Ruggedly constructed for long life, yet accurate and sensitive. Measures and transmits pneumatic signal proportional to flow, pressure, level or liquid density. All ranges 0-0.6-inch water to 0-750 psi. Pneumatic-electric and square root extracting models also available.

BOILER CONTROL PANEL
console type

See how Republic's new Bantam gauges and smaller subpanels permit more compact, yet easily read and operated console panels. Full sized model of console type panel will be on display at Republic booth for your inspection. Also get the facts about Republic's custom manufacturing of complete boiler control panels when you stop by.

IF YOU'RE NOT ATTENDING THE SHOW...

You can still get full facts about the equipment pictured at left, which will be on display, as well as about other instruments and controls in the Republic line. Write for descriptive bulletins.

THE COMPLETE REPUBLIC LINE INCLUDES

Complete Combustion Control Systems
For all types and sizes of boilers, all arrangements of draft, all types of fuel firing and all load conditions. Republic combustion controls are now operating hundreds of power plants, ranging from central stations to small industrial and institutional boilers.

Electrical Flow Meters
An exclusive feature—continuous integration—allows more accurate metering of steam, water, oil, etc.

CO_2 Meters
Provide a continuous record of per cent CO_2 in flue gas.

Draft Instruments
Indicating or recording types in single or multiple units. Furnished in all standard ranges of draft and pressure.

Thermometers
A long distance, gas filled thermometer with either single or multiple pen recorder.

Multi-Point Indicators
Will indicate, on separate vertical scales from two to sixteen units of draft, pressure, flow, temperature, CO_2 etc., in any combination desired.

Multiple Recorders
Round and strip types record as many as four and six separate readings respectively.

Regulators
For automatic control of flow, pressure, draft, fuel feed, speed of rotation, etc. Air or oil operated. Pneumatic or electronic remote setting.

Auxiliary Relays
Multiplying, dividing, adding, subtracting, maximum and minimum setting, ratio, ratio computing, sequential, splitter, squaring, square root extracting, and position indicating.

Desuperheaters
Steam atomizing type in all possible steam header sizes. Pressure standards 150 to 1500 psi.

2240 Diversey Parkway • Chicago 47, Illinois

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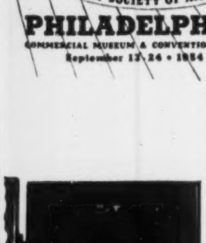
Taylor takes the

FIRST INTERNATIONAL
INSTRUMENT CONGRESS
and
EXPOSITION
BETTER LIVING THROUGH INSTRUMENTATION
1954
INSTRUMENT SOCIETY OF AMERICA
PHILADELPHIA
COMMERCIAL MUSEUM & CONVENTION HALL
September 13-24 • 1954



3. Automatic sequencing of batch operations. The Taylor FLEX-O-TIMER* Time Cycle Controller "does its own thinking"—takes care of as many as 36 operations automatically. Provides automatic timing of the sequence and duration of processing operations involving temperature, pressure, mechanical motion, electrical energy or combinations of each—precisely in accordance with a pre-determined schedule. Provides push-button operation for such jobs as: hydraulic press operation; batch charging and dumping; plastic molding operations; hydrogenation of edible oils and fats; dry ice molding; backwashing of catalyst and filter beds, etc.

4. Lifetime high accuracy in laboratory, routine testing. The name Taylor is your protection on etched stem thermometers and hydrometers. A.S.T.M.'s, Plain, Armored or Pocket-Type-thermometers are precision built and designed for maximum readability. Expertly annealed for minimum breakage. Specially aged before pointing and graduating for permanent accuracy. Taylor EASYKLEEN* Plain and Thermo-Hydrometers are built with the same precision. Streamlined designs assure correct readings, no trapping of bubbles on surfaces. They sink rapidly to floating point. Available with all scales recognized by the Bureau of Standards.

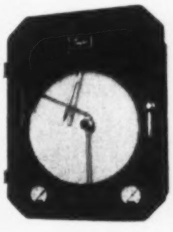
*Trade-Mark

For more information circle **29** on inquiry card.

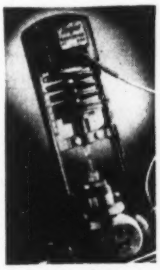
World's Temperature -

and that's not all . . . There are Taylor instruments for indicating, recording and controlling pressure, flow, liquid level, speed, load, density and humidity as well as temperature. We can supply you with a matched set of ASTM precision thermometers, or a completely-equipped graphic panel. And throughout the U. S. A., Canada, Australia, Europe, Latin America and many other parts of the world there are Taylor trained Field Engineers to help you with your instrumentation problems. Write for the name of your local man to Taylor Instrument Companies, Rochester, N. Y.

1. Graphic Panels requiring miniature instrumentation. The rapid advances of automation in recent years have necessitated the development of the graphic panel—and consequently miniature instrumentation. Taylor was one of the first in this field and the well known TRANSET* System carries many refinements of design based on actual field experience. For example, the need for more accurate measuring devices, due to separation of the functions of measurement and/or control and indication or recording, led to the use of the force-balance principle in transmitters. Thus the small power generated by minute changes of measurement can be transmitted with high accuracy to receivers. Taylor also contributed the TRANSET Plug-In Controllers and Receivers which reduce panel size, simplify mounting, mean fewer piping connections, easier maintenance and lower labor and material costs—***at no premium to you!***



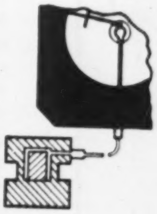
2. Complete local or point of measurement control. Fifteen years of unparalleled performance on all types of control problems have established the FULSCOPE* Controller as pre-eminent in accuracy, dependability and economy of operation. It is extremely versatile because the same control mechanisms are available for temperature, pressure, flow and liquid level—in either recording or indicating models, as locally mounted controllers, transmitters or controlling receivers. Interchangeable unit construction permits a small inventory of parts. Pre-calibrated units eliminate expensive checking. Easy accessibility means minimum down time. And the FULSCOPE Controller is adaptable to any control problem because of three control effects: Proportional Response, Automatic Reset Response, and PRE-ACT* Response (rate action) . . . another Taylor "first".



5. Dependable Non-Indicating Controllers for routine applications. The Taylor *Self-Acting Temperature Controller* (shown) is ideal for any process where air or electricity is not available and where "on the nose" control is not absolutely essential. Many ranges between 10° and 610°F. Can be used for valves up to 2"—direct or reverse acting.

The Taylor Type-P *Expansion Stem Temperature Controller* is designed for applications where "on-off" control is acceptable and where there's space for the 12" or 15" rigid expansion stem. Air operated: control point easily changed.

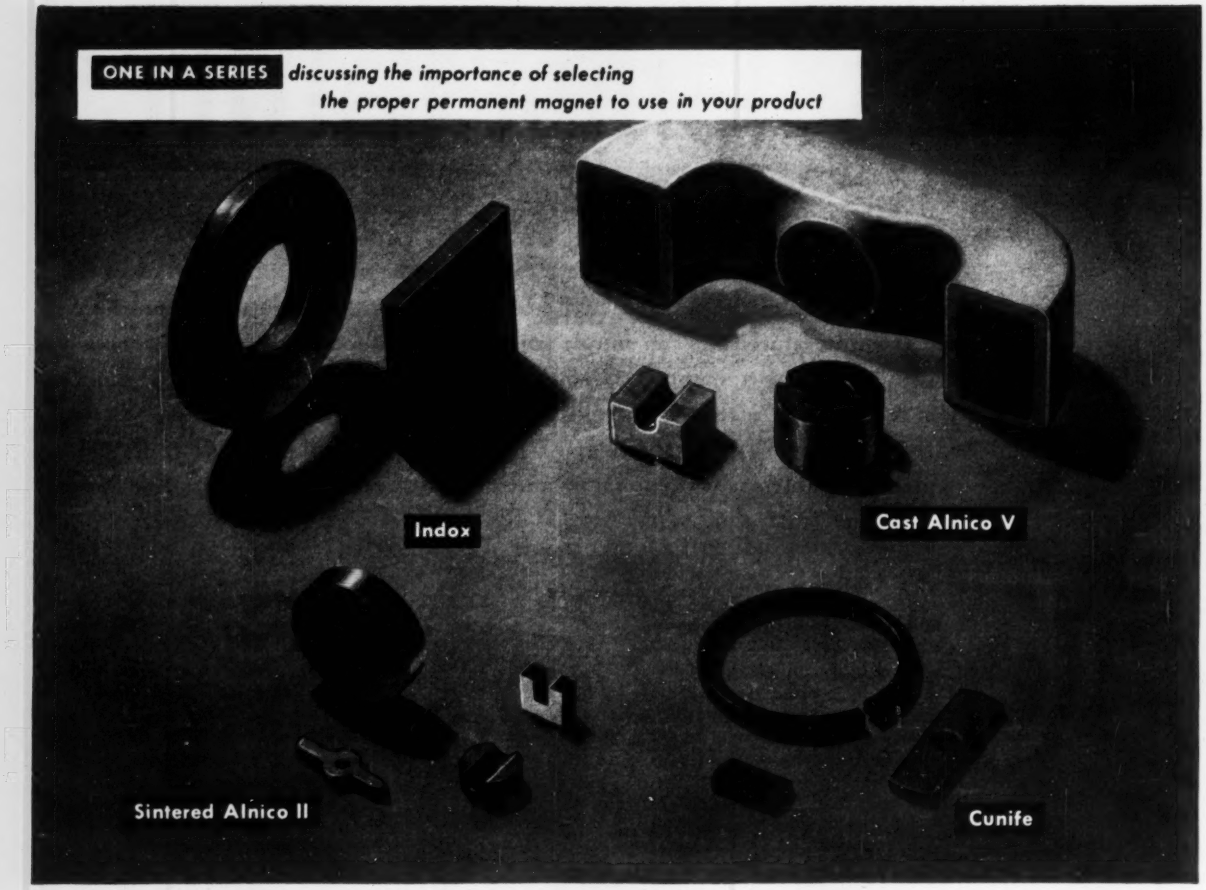
For simple pressure applications the Taylor *10RF Non-Indicating Controller* is available in direct or reverse-acting types. Air operated; sturdily built; inexpensive.



6. Simple, economical measurement of load or force. Taylor Volumetric Load Measuring Elements are rugged, self-contained units for measuring force *directly* on the chart or scale of a recording or indicating instrument. No auxiliary source of power is required. This is one of the simplest methods of determining tension, compression loads and combinations or both on most any type of equipment. The paper and textile industries have proved their design, accuracy and performance over many years, and recent developments have extended their utility to many other applications such as: measuring tension on conveyor belts; film tension; thrust on bearings; forces applied by pneumatic or hydraulic cylinders on squeeze rolls; weight of suspended solids or corrosive liquids in tanks, and force applied on testing apparatus.

***Taylor Instruments* MEAN ACCURACY FIRST**

For more information circle **29** on inquiry card.


ONE IN A SERIES discussing the importance of selecting the proper permanent magnet to use in your product
Indox
Cast Alnico V
Sintered Alnico II
Cunife

How the Right* Permanent Magnet Material Can Benefit Your Product

Of the many permanent magnet materials available—a few of which are shown above—only *one* will permit your product to *function best at the lowest possible cost.*

Which one is it? To help you answer that question properly is part of our job. As specialists in permanent magnets, we have helped to provide manufacturers with the answers for over 35,000 applications. The case of the telephone equipment manufacturer is typical. Perhaps we can assist you, too.

There is no charge . . . or obligation . . . for this service. Just write us, today, giving the details of your particular design problem. Or, ask for our Engineering Design Manual No. 4-D8. We'll be glad to provide both.

A Typical Case

. . . is that of a prominent telephone equipment manufacturer who changed from a chrome steel magnet to the use of Alnico III in his polarized relay. The results:

- **70% Savings in initial cost**
- **Simplified design**
- **Reduced weight**
- **Flux increase of 27% —improved performance**
- **Saving in space**
- **Less maintenance**

**** The one which will permit your product to function best at the lowest possible cost.***

THE INDIANA STEEL PRODUCTS COMPANY • Valparaiso, Indiana

World's Largest Manufacturer of Permanent Magnets

INDIANA PERMANENT MAGNETS

For more information circle **30** on inquiry card.

Just hearing a pin drop is easy...

New instruments analyze sound and put it in writing for you

Spectrum Recorder Model BL-2311

Since these new instruments present essential data so easily, they greatly simplify the analysis and control of sound, vibration, and noise.

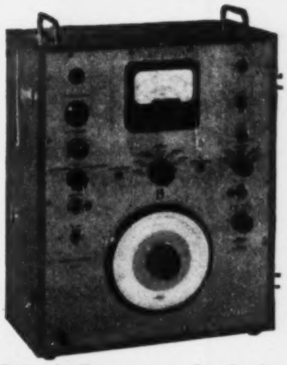
For example, the Spectrum Recorder automatically "scans" any sounds from 35 to 18,000 cycles per second in third-octave steps. Chart records, produced immediately, indicate both frequency spectrum and signal amplitude. The instrument saves hours of engineering time in analysis of sounds and vibrations, and in studies of strains, pressure variations, complex electrical voltages, and magnetic tape recordings.

Developed for laboratory use by Bruel & Kjaer, these instruments are finding ever-broader use in industry. For information on acoustical and electro-acoustical measurements that can be made easily with these instruments, write Brush Electronics Company, Dept. A-8, 3405 Perkins Avenue, Cleveland 14, Ohio. Send coupon today.

BRUSH ELECTRONICS BRUSH ELECTRONICS **COMPANY**

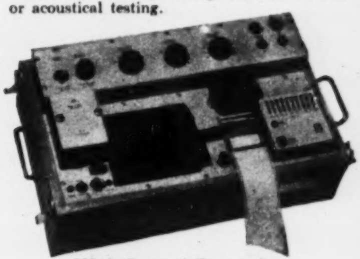
INDUSTRIAL AND RESEARCH INSTRUMENTS
PIEZO-ELECTRIC MATERIALS • ACOUSTIC DEVICES
MAGNETIC RECORDING EQUIPMENT
ULTRASONIC EQUIPMENT

formerly
The Brush Development Co.
Brush Electronics Company
is an operating unit of
Clevite Corporation.



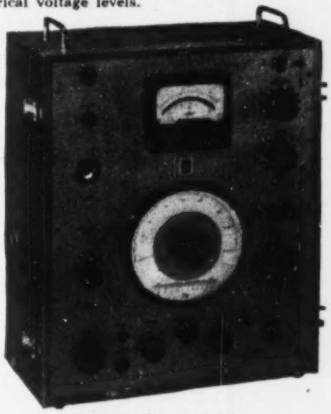
Speeds Frequency Analysis

The Audio Frequency Spectrometer measures amplitudes of the frequency components in complex a.c. voltages from 35 to 18,000 cps. Saves hours of engineering time in electrical or acoustical testing.



High Speed Recorder

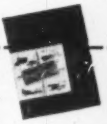
Level Recorder makes high speed recordings of signal level variations. Simplifies obtaining frequency response curves; useful in recording reverberation decay curves, noise levels, electrical voltage levels.



Versatile Signal Source

Beat Frequency Oscillator is a complete and flexible signal source. When coupled with the Level Recorder, Oscillator automatically sweeps through the audio frequency range. Permits fast, accurate recording.

Write for free brochure!



Brush Electronics Co., Dept. A-8
3405 Perkins Avenue
Cleveland 14, Ohio

☐ Please send brochure "Instruments for Sound Measurements".
☐ Have nearby representative call.

Name ....
Position ....
Company ....
Address ....
City .... State ....

For more information circle 31 on inquiry card.

PRECISION FREQUENCIES

ACCURACY: 1 PART IN 100,000 (OR BETTER) .001%

FOR USE IN SUCH FIELDS AS

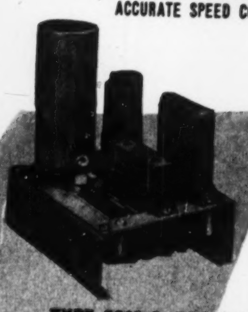
AVIATION
ASTRONOMY
BALLISTICS
HIGH-SPEED PHOTOGRAPHY
VISCOSITY MEASUREMENT
NUCLEAR PHYSICS
TELEMETERING
RADIATION COUNTING
FLUID FLOW
CHEMICAL REACTION
NAVIGATION
SCHOOL LABORATORIES
INDUSTRIAL RESEARCH LABS.
ACCURATE SPEED CONTROL

The controlling unit of these frequency standards is a bi-metallic fork, temperature-compensated and hermetically sealed against humidity and variations in barometric pressure. When combined with related equipment, accurate speed and time controls are afforded by mechanical, electrical, acoustical or optical means.

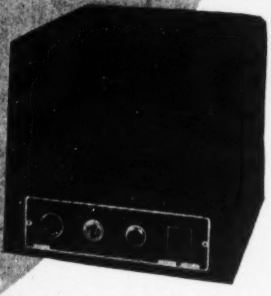
Instruments of our manufacture are used extensively by industry and government departments on such precision work as bomb sights and fire control.

Whatever your frequency problems may be, our engineers are ready to cooperate.

When requesting further details, please specify the Type Numbers on which information is desired.

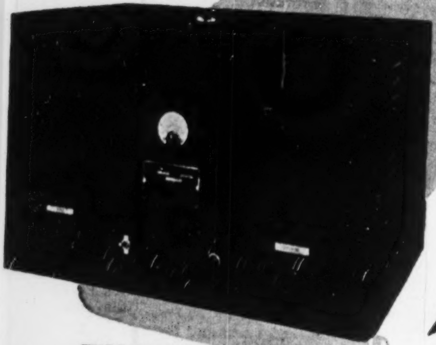


TYPE 2001-2. BASIC UNIT
Frequencies, 200 to 1500 cycles. Dividers and Multipliers available for lower and higher frequencies. Miniaturized and JAN construction. Output, 6 volts.



TYPE 2005. UTILITY UNIT
consists of Type 2001-2 and booster to provide 10 watts at 110 V at 60 cyc. Input, 50-100 cyc.

TYPE 2121A. LAB. STANDARD
Outputs, 60 cycle, 0-110 Volts. 120-240 cycle impulses. Input, 50-400 cycles, 45 W.



TYPE 2111. POWER UNIT
50 W output. 0-110 V at 60 cyc. Input, 50-100 cyc., 275 W.

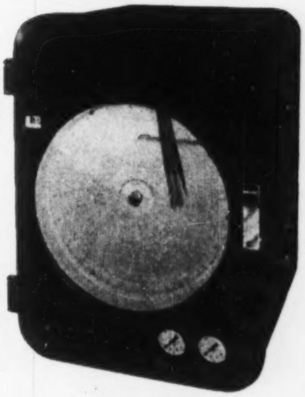
American Time Products, Inc.

580 Fifth Avenue
New York 19, N.Y.

OPERATING UNDER PATENTS OF THE WESTERN ELECTRIC COMPANY

For more information circle 32 on inquiry card.

for Reliable Measurement of low differentials



HAGAN

RING BALANCE METERS

Where flow measurements *must* be made with a low full scale differential, the logical choice is the Hagan Ring Balance Meter. This versatile meter, with no external sealing chambers, is equally useful for flow measurements at low differential or high differential, at high or low pressures.

Consider these advantages of the Hagan Ring Balance Meter

Interchangeable sensing elements, in a complete series, are available for measuring full scale differentials from 1″ to 420″ WC, at static pressure up to 3,000 psig.

The ring assembly is selected for each installation to assure ample power for accurate meter operation at all flows.

The differential range of any ring is adjustable over a 7 to 1 ratio.

The level of sealing fluid in the ring is not critical, the only requirement being sufficient depth to seal against maximum differential.

Calibration, using dead weights, takes only a few minutes. It is not necessary to disconnect the meter from the line.

Automatic compensation for such variables as temperature, pressure or fluid density is a standard attachment.

Pneumatic or electric signal transmission is available for remote recording or automatic control.

The Hagan Ring Balance Meter is the most versatile design available for flow measurements with any source of differential—orifice plate, venturi tube, pitot tube, weir or flume.

We will be glad to suggest the metering equipment best suited for improving existing facilities, or for extensions and new construction.

HAGAN
HALL
BUROMIN
CALGON

HAGAN CORPORATION

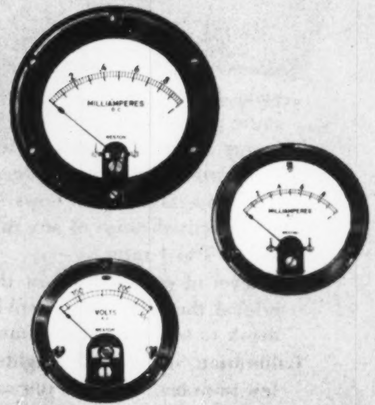
Hagan Building • Pittsburgh 30, Pennsylvania

Boiler Combustion Control Systems • Ring Balance Flow and Pressure Instruments • Metallurgical Furnace Control Systems
Control Systems for Automotive and Aeronautical Testing Facilities

For more information circle **33** on inquiry card.

9
HAMMER BLOWS
—UP TO
2,000 FOOT POUNDS EACH

WESTON RUGGEDIZED
INSTRUMENTS ARE AVAILABLE
FOR A-C AND D-C IN
2½", 3½", 4½" SIZES.



yet WESTON
RUGGEDIZED INSTRUMENTS
remain operable and accurate!

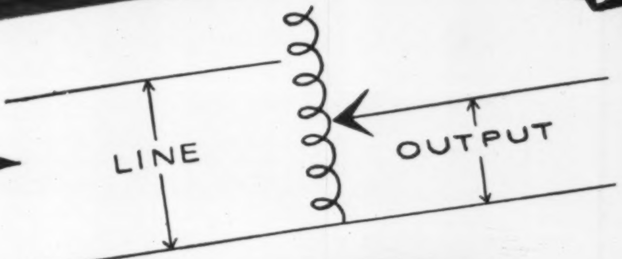
There's no guesswork about *ruggedizing* instruments at WESTON. Duplicates of *all* the approved equipment for testing – including the High Shock Hammers . . . the Vibrating and Tumbling equipment . . . the Temperature, and Moisture Cycling cabinets – all are here in the WESTON test department continually *proving* the soundness of WESTON's ruggedized design. Thus you can *be sure* each instrument not only meets the specifications for ruggedized instruments, but will also *prove* its superior ruggedness in service. WESTON Ruggedized instruments now are available for A-C and D-C requirements in 2½", 3½" and 4½" sizes. Bulletin giving complete information sent on request. WESTON Electrical Instrument Corporation, 614 Frelinghuysen Ave., Newark 5, N. J. 6917

WESTON *Instruments*

For more information circle **34** on inquiry card.

For Designs that Require Adjustable A-C Voltage

Put this symbol in your circuit and a POWERSTAT Variable Transformer in your products and you'll get:—



...Cool operation

...Power savings.. high efficiency

...Does not have to be tailored to the load

...Smooth control—glass smooth commutator surface

...Conservative ratings and easy, simple mounting

POWERSTAT
CONNECTIONS SHOWN FACING COMMUTATOR

▲ You can choose from a complete standard line of Powerstat variable transformers. Units are offered in manually-operated and motor-driven assemblies for 120, 240 and 480 volt duty in capacities from 150 VA to 100 KVA.

NEW
POWERSTAT
SMALL IN SIZE
BIG PERFORMANCE
TYPE 10 POWERSTAT

In many applications where you might usually use a rheostat, *investigate Powerstat variable transformer to do a better job* — and you can get a Powerstat for as little as $8.50.

You'll find Powerstats are superior. Their dimensional and physical characteristics make them easier to "design into" a product. Their conservative ratings, smooth operation and long life make them a "plus" feature of value.

For the best in continuously-adjustable voltage control use variable transformers. For the best in variable transformers always specify POWERSTATS.

Be sure to see Superior Electric's Mobile Display when it is in your area.

THE SUPERIOR ELECTRIC COMPANY

708 CLARKE AVENUE, BRISTOL, CONN.

Manufacturers of: Powerstat Variable Transformers • Stabiline Automatic Voltage Regulators • Voltbox A-C Power Supplies • Powerstat Light Dimming Equipment • Varicell D-C Power Supplies • Superior 5-Way Binding Posts

THE SUPERIOR ELECTRIC CO.
708 Clarke Avenue, Bristol, Conn.

Please send complete literature on Powerstat variable transformers.

Name..

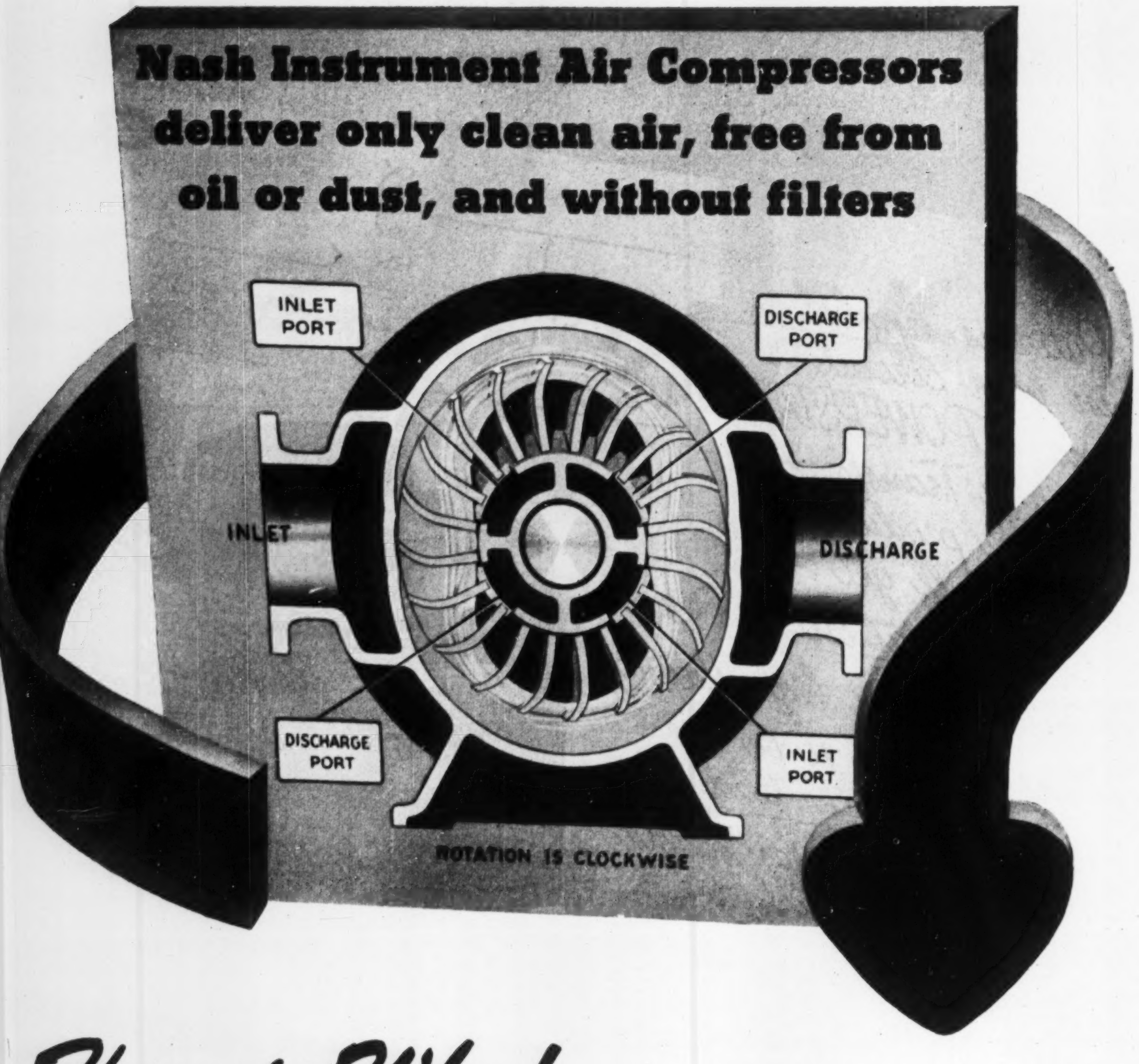
Position...

Company Name..

Company Address..

City..Zone......State.....................

For more information circle **35** on inquiry card.


Nash Instrument Air Compressors deliver only clean air, free from oil or dust, and without filters
INLET PORT
DISCHARGE PORT
INLET
DISCHARGE
DISCHARGE PORT
INLET PORT
ROTATION IS CLOCKWISE

Here is Why!

You can dispense with oil filters and dust filters when you install ®Nash® Clean Air Compressors. You can save the cost of maintaining these devices. You can greatly reduce instrument maintenance costs. For the Nash employs no internal lubrication, therefore no troublesome oil is in the delivered air. Moreover, air from a Nash is thoroughly washed and cooled as it passes thru the pump. Dust in the plant atmosphere, even fly ash, is immediately removed.

®Nash® Clean Air Compressors are simple, with only one moving element. No valves, gears, pistons, sliding vanes, or other enemies of long life and constant performance complicate a Nash. No aftercoolers are needed. You will find it profitable to investigate these pumps, now.

No oil filters.
No dust filters.
No internal lubrication to contaminate air handled.
No internal wearing parts.
No valves, pistons, or vanes.
Non-pulsating pressure.
Original performance constant over a long pump life.
Low maintenance cost.

NASH ENGINEERING COMPANY
370 WILSON, SO. NORWALK, CONN.

BENDIX ULTRA-VISCOSON

Bendix
Ultra-Viscoson

measures, records and controls viscosity instantly, continuously, automatically!

This unique electronic instrument—the Bendix Ultra-Viscoson—provides *instant, continuous* and *automatic* viscosity measurement of hundreds of fluid materials in any stage of processing. All you do to get an accurate viscosity check is look at the dial. And all you do to install it is insert the small, rugged probe—by means of threaded connections—in a pipeline, kettle, pressure vessel, fractionating tower or tank.

In addition to indicating viscosity, the Bendix Ultra-Viscoson can be connected directly to any standard recorder or recorder-controller to automatically record and control viscosity in continuous processes.

You'll realize substantial savings, too, with a Bendix Ultra-Viscoson on the job. It completely eliminates costly work stoppage, sample taking, lengthy laboratory analyses and human error. Find out how you can improve your operation with a Bendix Ultra-Viscoson. Write today for complete information.

Simple ... Flexible ... Reliable!

No moving parts • Hermetically sealed probe • Operates in temperatures up to 650°F. and pressures of 1000 p.s.i. (special units available for higher pressures) • Measures in milliseconds • Remote operation • Permanently installed probe • Easily combined with remote recorder and automatic controls • Multi-probe and automatic temperature compensating systems available

FOR FULL PARTICULARS WRITE TO

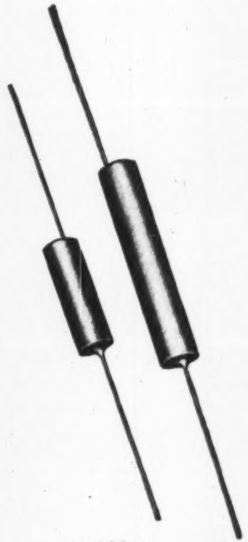
CINCINNATI DIVISION OF
203 W. 3rd Street, Cincinnati 2, Ohio

THE NAME Bendix AVIATION CORPORATION MILLIONS TRUST

Export Sales: Bendix International Division, 205 East 42nd St., New York 17, N. Y.

For more information circle **36** on inquiry card.

QUALITY CAN COST LESS



Available sizes:	
4 watt	1 to 1000 ohms 5/16" dia. x 1" long
7 watt	1 to 5000 ohms 5/16" dia. x 1¾" long
Standard Tolerance	10%

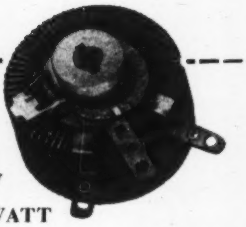
...And MALLORY Ceramic Resistors Prove It!

Wherever you need fixed resistors in television and other electronic circuits, you can get an ideal combination of quality and economy in Mallory Ceramic Resistors. They're low in cost—and their axial lead construction cuts production expense by eliminating mounting brackets, permitting point-to-point wiring and saving under-chassis space.

These features assure top quality performance:

- *Accurate resistance up to rated wattage through the use of exclusive Mallory Yard-Ohm wire.*
- *Long life: Fiberglas core contains no organic materials: high grade non-corrosive inorganic cement, injected under pressure to give high heat dissipation, holds resistance element securely. Resistors are built to take 100% overloads.*
- *Moisture protection: Resistor ends are sealed by special heat and moisture resistant compound.*
- *Rugged construction: tinned leads are securely clinched to prevent opens, high resistance and pull-outs. Non-porous steatite tubes protect against mechanical and thermal shock.*

For complete facts, write for the new catalog on fixed wire-wound resistors and carbon and wire-wound controls.



NEW 25-WATT RHEOSTAT

A line of wire-wound rheostats, with ranges from 1 to 2500 ohms, is now available. A patented hinged-spring contact arm provides smooth rotation and assures correct, constant pressure against the winding. Write for information.

***Expect more . . . Get more from* MALLORY**

Parts distributors in all major cities stock Mallory standard components for your convenience

P.R. MALLORY & CO. Inc.
MALLORY
P. R. MALLORY & CO., Inc. INDIANAPOLIS 6, INDIANA

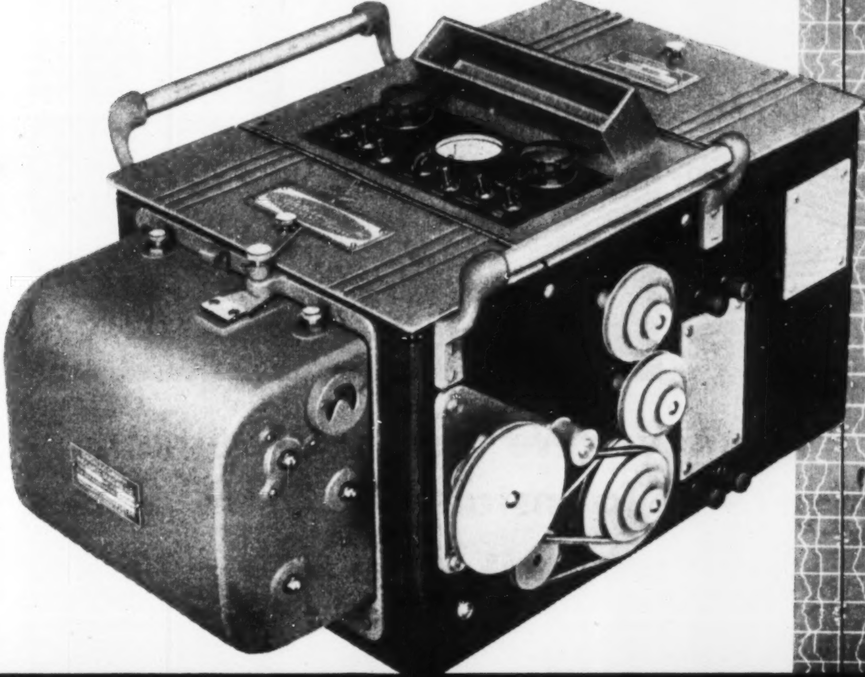
Serving Industry with These Products:
Electromechanical—Resistors • Switches • Television Tuners • Vibrators
Electrochemical—Capacitors • Rectifiers • Mercury Batteries
Metallurgical—Contacts • Special Metals and Ceramics • Welding Materials

For more information circle **37** on inquiry card.

YOU can't afford to be without the

LOW COST

HATHAWAY S14-C OSCILLOGRAPH



the world's most complete and versatile OSCILLOGRAPH

for recording electrical quantities, processes, flight functions, dynamic pressure, strain, vibration, acceleration, temperature...

for testing relays

for testing welding equipment

for biological recording

for analysis of high-speed engines and compressors

Galvanometers are available for current, voltage, power, covering a most extensive range of characteristics.

Attachments available for almost any recording need—
- automatic transient recording
- wave-shape measurements
- wave-shape scanning
- long records to 100 inches per second
- short records to 1,000 inches per second

PROVE TO YOURSELF THAT THE S14-C IS...

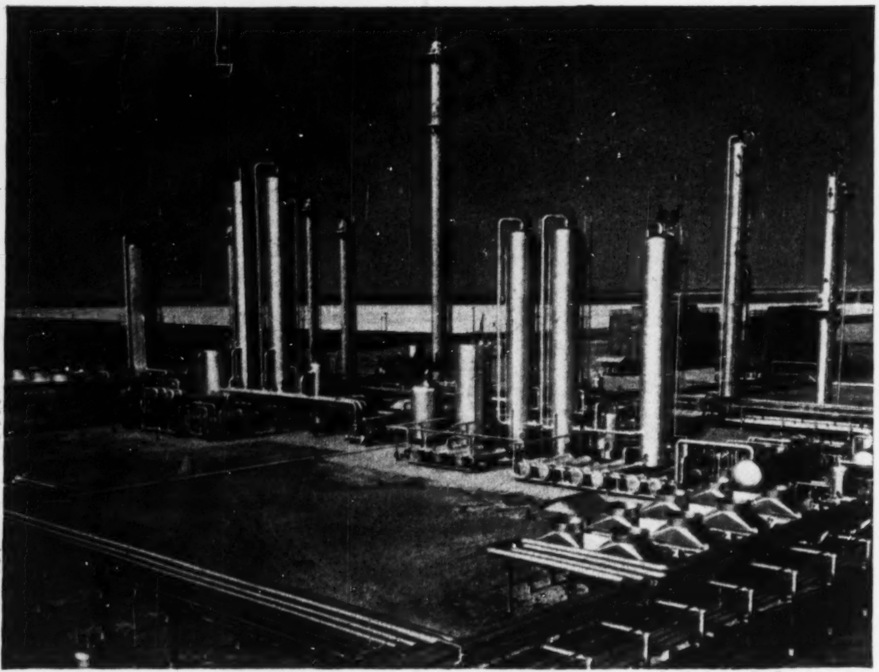
• The Most Versatile • The Easiest to Maintain • The Easiest to Operate • The Finest in Craftsmanship

Write for Bulletin No. 2D-1L and your free copy of Hathaway Engineering News

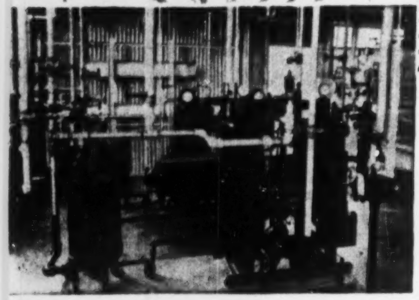
4204

Hathaway
INSTRUMENT COMPANY
1315 SO. CLARKSON STREET • DENVER 10, COLORADO

For more information circle **38** on inquiry card.



"Whenever We Install Instruments, We Prefer To Install Air Driers... *regardless of outside humidity!*"



This fully automatic Lectrodryer DRYs instrument air prior to its being fed to the many pneumatically operated instruments at the Stanolind Oil & Gas Company's Stano Gasoline Plant, Ulysses, Kansas, pictured above.

"There's no cause to worry if you DRY instrument air. It assures trouble-free operation." These statements were made by the Stearns-Roger Company of Denver, the firm that engineered the Stanolind Oil & Gas Company plants of the type pictured.

To prevent cold weather air line freeze-up . . . to halt rust, scale and sludge in air lines, you must get rid of moisture. You can do this by installing a Lectrodryer*. These machines work continuously, automatically and economically, extracting vaporous moistures from instrument air . . . reducing the dewpoint in air lines to as low as −100° F.

Install a Lectrodryer in your instrument air lines. It's the safest and most economical way to keep harmful moisture from your instruments.

Write for *Because Moisture Isn't Pink*, a booklet describing what Lectrodryers are, how they work and how they are being used in industry. Pittsburgh Lectrodryer Corporation, 330 32nd Street, Pittsburgh 30, Pennsylvania.

In England: Birlec, Limited, Tyburn Road, Erdington, Birmingham.
In France: Stein et Roubaix, 24 Rue Erlanger, Paris XVI.
In Belgium: S. A. Belge Stein et Roubaix, 320 Rue du Moulin, Bressoux-Liege.

LECTRODRYERS DRY WITH ACTIVATED ALUMINAS

LECTRODRYER

* REGISTERED TRADEMARK U. S. PAT. OFF.

For more information circle **39** on inquiry card.

PRECISION PRESSURE MEASUREMENT

of Gauge Pressure, Vacuum or Differential Pressure

MERCURY
120 INCHES
MODEL NO.
SERIAL NO.
VERTICAL
WALLACE & TIERNAN PRODUCTS INC.
BELLEVILLE NEW JERSEY
DIFFERENTIAL PRESSURE
1
2
3
4
5
6
7
8
9
10
INCHES OF WATER

Precision Dial Manometer Type FA-145

Accuracy:
1 part in 1000 over full scale.
Sensitivity:
1 part in 10,000 in *all* ranges.
Ranges:
0 to 120 inches of water (min.)
0 to 250 inches of mercury (max.)
Other intermediate ranges available.
Scale Length:
45 inches.
Dial Diameter:
8½ inches.

Precision Low Pressure Gauge Type FA-141

Accuracy:
1 part in 300 over full scale.
Sensitivity:
1 part in 500 in *all* ranges.
Ranges:
0 to 10 inches of water (min.)
0 to 400 inches of water (max.)
Other intermediate ranges available.
Scale Length:
7 or 16 inches.
Dial Diameter:
2¾ or 6 inches.

WALLACE & TIERNAN
INCORPORATED
PRECISION INSTRUMENTS AND ELECTRICAL MECHANISMS
25 MAIN ST. BELLEVILLE 9, N. J.
In Canada Wallace & Tiernan, Ltd. Toronto

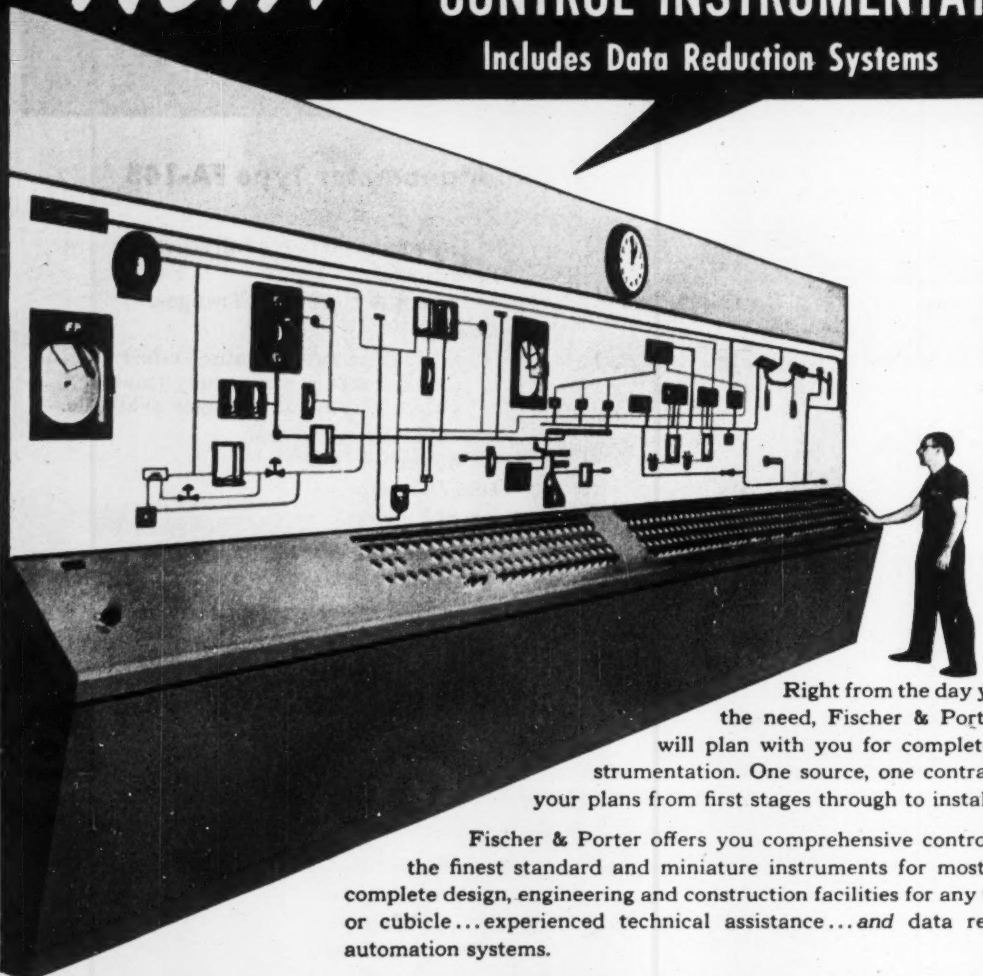
For additional data, write for Publication TP-30-A and TP-27-A

A-101

For more information circle **40** on inquiry card.

NOW! FISCHER & PORTER'S COMPLETE CENTRALIZED CONTROL INSTRUMENTATION

Includes Data Reduction Systems

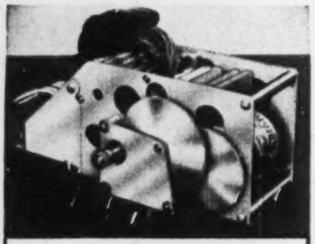


Right from the day you recognize the need, Fischer & Porter Company will plan with you for complete process instrumentation. One source, one contract—will take your plans from first stages through to installation.

Fischer & Porter offers you comprehensive control coverage—the finest standard and miniature instruments for most variables... complete design, engineering and construction facilities for any type of panel or cubicle... experienced technical assistance... *and* data reduction and automation systems.

And F & P complete service costs less, because of the complete handling from beginning to end in one plant.

Use all the advantages of automation. Write, call or wire today for complete information and engineering assistance.



F & P is first with a Data Reduction and Automation Division. Now available is a new digital converter, which provides completely automatic logging from sensing elements to coded or tabulated digital data output.

complete process instrumentation

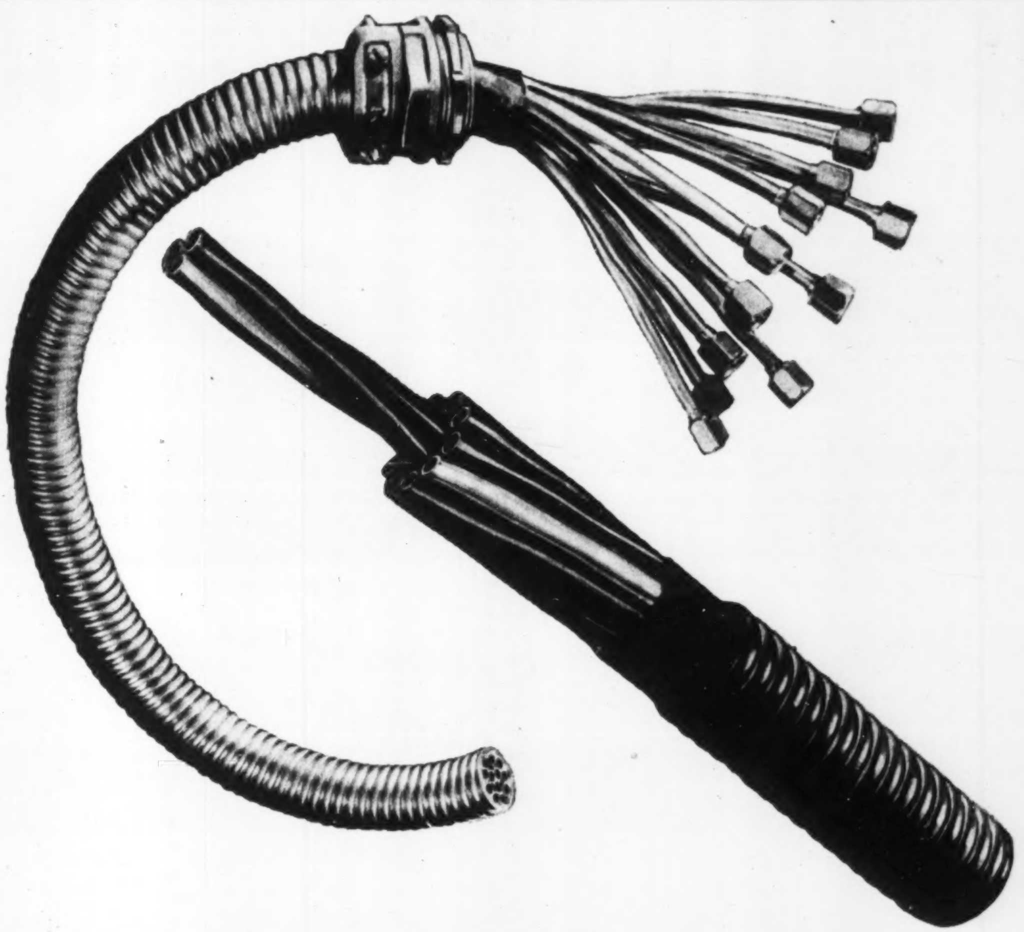
FISCHER & PORTER CO.

5483 County Line Road, Hatboro, Penn.

Measuring, Recording, and controlling instruments—Control Panels—Data Reduction Systems—Contract Instrumentation Research—Chlorination Equipment—Glass Specialties.

LA-1004

For more information circle **41** on inquiry card.



CRESCENT ARMORED MULTITUBE

For use with instruments and process control equipment

Here is a new way to make substantial savings on moderate to long runs of ¼", 5/16", ⅜" and ½" O.D. copper tubes.

CRESCENT ARMORED MULTITUBE is an armored group of long length tubes twisted together to permit bending without any distortion of the tubes, which are thoroughly protected from injury during and after installation by a flexible, interlocked, galvanized steel armor.

One tube in each layer has a bright blue color, which permits a ready identification of each tube at both ends. This is a real time-saving feature as the installers can connect both ends without the necessity for tracing through each tube. The relative position of each tube in each layer, with respect to the color-coated tube in that layer, remains the same throughout any length of ARMORED MULTITUBE.

Long, continuous lengths up to 1,000 ft. save waste and short ends. Tubes are also available in ¼" O.D. aluminum, polyethylene and other plastics. Licensed under U.S. Patent 2,578,280.

SEND FOR BULLETIN GIVING COMPLETE INFORMATION AND ENGINEERING DATA

CRESCENT
INSULATED WIRE & CABLE CO.
TRENTON, N. J.

Visit us at Booth 340, International Instrument Exposition, Philadelphia

For more information circle **42** on inquiry card.

NEW ATOMIC CANNON

keeps its own score on this Veeder-Root Counter

(U.S. ARMY PHOTO)

Added Evidence that—

Everyone Can Count on VEEDER-ROOT

This mobile 280 mm. atomic cannon has *two* recoil motions. The primary recoil absorbs the cannon's "kick". The secondary recoil (something new in artillery) absorbs the forces created by the primary recoil. And each recoil motion is recorded by this special Veeder-Root Counter designed with a plunger-action shaft . . . which keeps the score on the cannon's use and indicates approaching need for maintenance.

This again points up the fact that "Anything Worth Making — or Worth Doing — *Is Worth Counting*." And Veeder-Root has the experience and resources *you* can count on, to give you any counter you need . . . for any mechanical or electrical application . . . in any field from Atomics to Automation. Write:

VEEDER-ROOT INCORPORATED
HARTFORD 2, CONNECTICUT

Chicago 6, Ill. • New York 19, N. Y. • Greenville, S. C.
Montreal 2, Canada • Dundee, Scotland
Offices and Agents in Principal Cities

"The Name that Counts"

For more information circle **43** on inquiry card.

Federal

DIVISION OF IT&T

ANNOUNCES

the organization of an

INSTRUMENT DIVISION

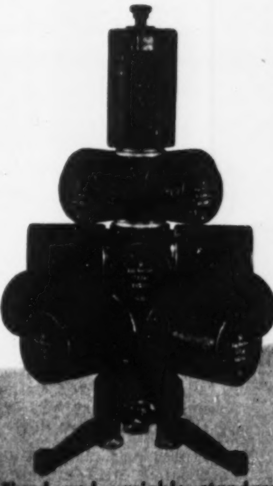
for the manufacture and distribution of precision-built

MEASURING AND TESTING INSTRUMENTS

for science and industry

Unique in design and construction and engineered to provide the utmost in accuracy and dependable performance, this equipment brings to American research and industry the products of domestic and foreign manufacturing divisions of the world-wide IT&T system—as well as those of outstanding independent instrument makers abroad.

Frequency Decade by Rohde and Schwarz, 30 cps to 600 mc—accuracy ± 1 x 10−7



Fixed and variable standard capacitors and connecting base by R. Jahre.

SEE FEDERAL'S EXHIBIT AT THE

FIRST INTERNATIONAL INSTRUMENT CONGRESS AND EXPOSITION

COMMERCIAL MUSEUM AND CONVENTION HALL

PHILADELPHIA SEPT. 15-22 BOOTHS 202 and 204

Federal Telephone and Radio Company

INSTRUMENT DIVISION, 100 KINGSLAND ROAD, CLIFTON, N. J.

For more information circle **44** on inquiry card.

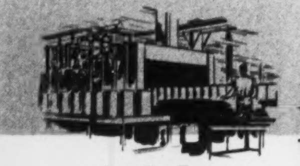
A guide for selecting temperature control for top furnace performance

Today, industry's need for lower operating costs ... reduced maintenance ... high quality of production ... has spot-lighted the importance of "tight" furnace control.

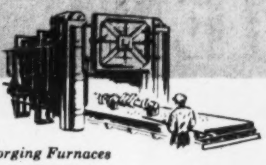
With closer specifications and higher control standards, more and more plants must pin down troublesome, costly departures from favorable heat-treating conditions.

To meet this demand, Leeds and Northrup has a complete line of matched temperature control systems available. You get equipment matched to your particular requirements. Each system comes to you as a "package" ready to handle the individual conditions created by your product, your production and your furnace.

There's an L&N control to match every industrial furnace



Annealing Furnaces



Forging Furnaces

TWO-POSITION CONTROL

For fuel-fired or electric furnaces

What it does:

Cuts heat input back to "low" when temperature exceeds control point . . . turns heat input on full when it falls below control point.

When to use it:

1. When changes in heat supply or changes in load are promptly "felt" by the temperature detector.

2. When alternate undershoot and overshoot will not damage product or process equipment, or slow down production.

3. When furnace pressure or fuel-air ratio *are not* controlled and the products of combustion *do not* form a protective atmosphere for the work.

PROPORTIONING-TYPE CONTROL

For fuel-fired furnaces

What it does:

Adjusts heat input by varying valve opening according to size of temperature change.

When to use it:

1. When there's a substantial time lag, before changes in heat supply or changes in load are "felt" by the temperature detector.

2. When load changes on continuous processes are both small and infrequent, and control point is rarely changed.

3. On batch process where operation is usually at the same temperature, and rapid recovery from upsets after loading is not important.

4. When furnace-pressure or fuel-air ratio *are* controlled, or the products of combustion *do* form a protective atmosphere for the work.

POSITION-ADJUSTING-TYPE CONTROL (P.A.T.)

For fuel-fired furnaces

What it does:

Adjusts heat input by varying valve opening according to size, duration and speed of temperature changes.

When to use it:

1. When there's a substantial time lag, before changes in heat supply or changes in load are "felt" by the temperature detector.

2. When load changes are both large and frequent and control point must be changed to suit various conditions.

3. When furnace design requires a continuously throttled flame.

4. When furnace-pressure or fuel-air ratio *are* controlled, or the products of combustion *do* form a protective atmosphere for the work.

5. Whenever overshoot is costly, hazardous or can cause damage to the product or heating equipment.

DURATION-ADJUSTING-TYPE CONTROL (D.A.T.)

For fuel-fired or electric furnaces

What it does:

Adjusts heat input by varying length of "heat on" time according to size, duration and speed of temperature changes.

When to use it:

1. When there's a substantial time lag, before changes in heat supply or changes in load are "felt" by the temperature detector.

2. When load changes are both large and frequent, and control point must be changed to suit various conditions.

3. When furnace design requires use of "on-off" operation of heat supply.

4. When furnace-pressure or fuel-air ratio *are not* controlled, and the products of combustion *do not* form a protective atmosphere for the work.

5. Whenever overshoot is costly, hazardous or can cause damage to the product or heating equipment.

***For complete information** regarding L & N Matched Temperature Control, write 4955 Stenton Ave., Phila. 44, Pa., or contact our nearest office.*

LEEDS NORTHRUP

instruments *automatic controls • furnaces*

For more information circle **45** on inquiry card.

Editorial...

Instruments and AUTOMATION

Instrument Event of the Year

Beginning on page 1172 of this issue is the list of exhibitors at the forthcoming First International Instrument Exposition. The vast size of this event will make it necessary for all instrument men to control their time in order to achieve optimum benefit from their attendance at this show; we urge careful study of the list with this end in mind. Those of you who will not be able to attend can obtain additional information on any exhibited products listed by letting us know in which instruments you are interested. And, of course, you will learn of the highlights of the show from our post-show special issue, the November issue of *Instruments and Automation*.

Electronic Computer Clinic

Announcement is made of the FIRST ELECTRONIC COMPUTER CLINIC, to be held in conjunction with the FIRST INTERNATIONAL AUTOMATION EXPOSITION, at the 244th Regiment Armory, 14th Street between 6th and 7th Avenues, New York, N. Y., November 30 to December 2. (The Exposition dates are November 29—December 2.)

The clinic will be a lecture and demonstration course on electronic computers, digital and analog, and will offer, for the first time, demonstrations and typical applications of different types of computers. The wide general interest in applications of electronic computers assures that this Clinic will be of great importance in opening up the application possibilities of electronic computers within the vast field of automation.

The Clinic is planned for top management, production engineers, instrument engineers, physicists, chemists, and others who contemplate using computers in the plant or laboratory. Advance registration will be required and is now being offered via nation-wide publicity. No registration will be accepted from individuals employed by computer manufacturers.

Attendance at the sessions will be restricted in size. Sessions will be repeated up to a maximum of 9 times to accommodate registrants. The registration fee is $5.00, payable in advance.

After the conclusion of the sessions, each registrant will receive a complete set of the lectures. It is expected that the advance registration will exceed the number that can be accommodated. Therefore, it is essential to register early.

Advance-registration forms can be obtained from Richard Rimbach, Electronic Computer Clinic, 845 Ridge Ave., Pittsburgh 12, Pa.

Importance to Instrument Users

Limited knowledge of the process itself hinders extensive application of computers in closed-loop control systems. This knowledge will be forthcoming when Instrument Departments in process industries make efforts to analyze the processes within the plant for the express purpose of use with computers. *This will soon be done.* The increasing amount of information that must be processed through the Instrument Department is making use of digital computers an economic possibility—and increasing importance of finding optimal methods for control is making use of analog computers economic.

The progressive Instrument Department of tomorrow will have its own computer section in which full-time personnel will simulate all operations within the plant, using performance charts to obtain equations and parameters, using analog computers to seek optimal methods and techniques for control of all operations within the plant, and using digital computers to solve difficult problems, to handle the mass of data from instruments within the plant, and to provide digitized answers to all operational problems within the plant. The Instrument Department is becoming a Communication Center whose job is to translate intelligence from the plant into data permitting management to make decisions—not only to open valves, but also to spend money.

The impasse that at present blocks use of computers within the Instrument Department is this: Limited knowledge of process functions prevents application of computers within the plant—and limited knowledge of simulation techniques is holding back the development of data on the process functions. The Instrument Department holds the key to this situation. Progressive heads of Instrument Departments will learn the techniques for use of digital and analog computers—NOW. The Computer Clinic is thus of great immediate importance to this group of men.

Importance to Computer Manufacturers

Instrument users and manufacturers are but two groups of men who need to learn the techniques and applications of computers. Other groups also will be represented in the registrants to the Computer Clinic. Despite the mass of material written about computers, *it is lack of knowledge about proper application that most hinders purchase of computers* by organizations and men who might use them. And nothing will instill this knowledge—together with confidence in the power of these new tools—as will a series of Clinic sessions complete with working demonstrations of typical solutions. Only eight computer firms can be accommodated in the Computer Clinic. Please contact Richard Rimbach, Electronic Computer Clinic, 845 Ridge Ave., Pittsburgh 12, Pa.

Roster of Control Engineers

A roster of names of men whose duties are primarily control engineering is being compiled by The Instruments Publishing Company. Men whose titles are CONTROL ENGINEER, AUTOMATION ENGINEER, SYSTEMS ENGINEER, FEEDBACK ENGINEER, METHODS ENGINEER, etc., are urged to send their names, titles, and addresses to the Roster of Control Engineers, 845 Ridge Ave., Pittsburgh 12, Pa.

First International Instrument Exposition

EXHIBITORS and their PRODUCTS

Booth No.

Abrams Instrument Corp., Lansing 1, Mich. 323
Exhibiting: New Products—Stereocartograph for picking contour lines off aerial stereophoto pairs for topographic mapping. **Regular Products**—Intervalometers; counters; count limiters; photogrammetric and camera control units.

ACF Industries, Inc., Valve Div., (Formerly American Car & Foundry Co.) Detroit 11, Michigan 560, 562
Exhibiting: New Products—Motor- and cylinder-operated and special throttling type lubricated plug valves; ball-type non-lubricated valves. **Regular Products**—Lubricated and non-lubricated plug valves.

Acro Switch Div., Acro Mfg. Co., Columbus 16, Ohio 958
Exhibiting: New Products—Wide-temperature-range switch; vibration- and shock-resistant switch. **Regular Products**—Switches.

Adams & Westlake Co., Elkhart, Ind. 311
Exhibiting: Relays (mercury, plunger-type).

Aero Service Corp., Philadelphia 20, Pa. 231
Exhibiting: Aerial photography; photogrammetric supplies.

A' G' A' Division, Elastic Stop Nut Corporation Elizabeth 3, New Jersey 251
Exhibiting: Agastat time delay relays.
See ad on page **1174**. Circle **203** on inquiry card.

Ahrendt Instrument Co., College Park, Md. 920
Exhibiting: New Products—Synchro zeroing fixture; sequence timer; precision gears. **Regular Products**—Naval gun fire control and navigational equipment; dummy director; magnetic and servo amplifiers; servomechanisms; limiters.

Airlectron, Inc. (See Kay Electric Co.) 1605

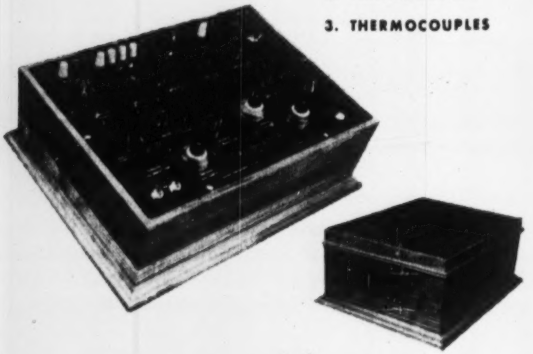
Alina Corporation, New York 13, N. Y. 844
Exhibiting: Mechanical chart drives; chart drive to SAMA specification; pressure gage, and anemometer movements; time switches; interval timers; differentials, pinions, worms, etc.; subassemblies.

Allegany Instrument Company, Inc., Cumberland, Md. 555, 557
Exhibiting: New Products—Cathode-ray oscillographs; drum camera; strain-gage calibrator; bridge-balancing units. **Regular Products**—Millivolt source; dynamic temperature and strain recorders; d-c. amplifiers.
See ad below. Circle **199** on inquiry card.

Allegemeine Elektricitats-Gesellschaft, Philadelphia, Pa. 355
Exhibiting: Electrical measuring and industrial control instruments.

A UNIVERSAL TOOL FOR THE STANDARDIZATION OF . . .

1. WIRE STRAIN GAGES
2. TRANSDUCERS
3. THERMOCOUPLES



type c, calibrator

FEATURES:

1. CALIBRATES 1, 2, AND 4 ACTIVE STRAIN GAGES AND TRANSDUCERS.
2. FACTOR IS OBTAINED EITHER BY CONSTANT CURRENT OR CONSTANT VOLTAGE METHOD.
3. INCORPORATES SERIES, SINGLE AND DOUBLE SHUNT SYSTEMS.
4. INCLUDES ALL THE NECESSARY CALIBRATION RESISTORS.
5. ACCURACY OF MEASUREMENT IS 0.1%.
6. DIALS READ DIRECTLY IN PRESSURE, FORCE, ACCELERATION, ETC.

ALLEGANY INSTRUMENT COMPANY
1000 OLDTOWN ROAD CUMBERLAND MARYLAND

For more information circle **199** on inquiry card.

Booth No.

Theo. Alteneder & Sons, Philadelphia 23, Pa. 325
Exhibiting: Drafting instruments and scales; special engineering instruments.

Serving Engineers, Architects and
the Graphic Arts with Instruments
of highest quality for 104 years.

Theo. Alteneder & Sons

1217 Spring Garden Street, Zone No. 23, Philadelphia, Pa.

For more information circle **200** on inquiry card.

American Cystoscope Makers, Inc., New York 59, N. Y. 940, 942
Exhibiting: New Products—Borescopes; forward, for-oblique, right angle and retrospective vision instruments.

American Instrument Co., Inc., Silver Spring, Md. 832, 834
Exhibiting: New Products—Calibration bath; Jonnard refractometer; micro-bore gage; autocollimator; high-vacuum fittings; Measurescope. **Regular Products**—Climate Lab; Electric hygrometer; Magne-gage; absorption cells; microphotometer; adjustable-stroke pump; immersion heaters; relays, regulators; sub-zero cabinet.
See ad on page **1175**. Circle **207** on inquiry card.

American Laubscher Corp., New York 19, N. Y. 1153
Exhibiting: New Products—Centerless ground and polished products; small stampings and dies; pinions, gears, etc.; instrument jewels; color anodized plates, dials, panels, scales.

AMERICAN LAUBSCHER CORPORATION

333 West 52nd Street, New York 19, N. Y.

Headquarters for Precision Fabricated Metal Products,
Custom Made, Close Tolerances

See our interesting exhibit at booth No. 1153

For more information circle **201** on inquiry card.

American Meter Co., Inc., Philadelphia 2, Pa. 901, 903
Exhibiting: Orifice meter and plates; wet & dry test meters; gage line connections; meter run, complete with 3-pen meter, straightening vanes, etc.; needle valves; integrating Metameter receiver with Telecounter.
See ad on page **1339**. Circle **178** on inquiry card.

American Phenolic Corp., Chicago 50, Ill. 351
Exhibiting: New Products—Microphone connectors; miniaturized AN connectors; glass insert sealed connectors; connectors with keyed shells, floating mounts, and latch plug. **Regular Products**—Grouping representative of 11,000 electronic components.
See ad on page **1342**. Circle **182** on inquiry card.

Ampex Corp., Redwood City, Calif. 842
Exhibiting: Magnetic tape recorders for industrial instrumentation.

Analytical Measurements, Inc., Chatham, N. J. 407
Exhibiting: New Products—Industrial pH meter. **Regular Products**—Pocket-size pH meter.
See ad on page **1226**. Circle **64** on inquiry card.

Anders Lykens Corp., Lykens, Pa. 145
Exhibiting: New Products—Oil prefilter and air aftercooler; high-pressure air-gas dryer. **Regular Products**—Instrument air dryer.

Anderson & Sons, Inc., Westfield, Mass. 527, 529
Exhibiting: New Products—Adhesive-backed metal nameplates; etched circuits; adding machines for adding and subtracting fractions. **Regular Products**—Dials, panels, nameplates, etc.; employee photo identification equipment.

Philip M. Andress, Philadelphia 29, Pa. 957
Exhibiting: Representing—Bolta Products Div. of General Tire and Rubber; Enthoven Solders, Inc.; Nureco Inc.; Duramark, Inc.; Varflex Corp.

H. Reeve Angel & Co., Inc., New York 7, N. Y. 451
Exhibiting: New Products—Glass fiber filter papers. **Regular Products**—Filter papers; cellulose powders; extraction thimbles; lens wiping tissue.

Annin Co., Los Angeles 22, Calif. 659, 661
Exhibiting: New Products—6, 8, 10, & 12-in. control valves; "D" Domotor operators; control valves for high pressures and temperatures; catalyst slide valves; catalyst fines and solid chemicals. **Regular Products**—Domotor and Wee Willie control valves.
See ad on page **1134**. Circle **15** on inquiry card.

Applied Research Labs., Glendale, Calif. 205, 207
Exhibiting: New Products—X-ray Industrial Quantometer, using x-ray fluorescence spectra. **Regular Products**—Grating spectographs; densitometers; sample excitation units; Quantometers, optical emission.

Aremac Associates, Pasadena 3, Calif. 336
Exhibiting: New Products—Data cameras, 35mm, various shutter

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THEY SAY DIRECT CURRENT TRANSMISSION IS BEST
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First International Instrument Congress & Exposition
Philadelphia • September 15-22
MANNING, MAXWELL & MOORE, INC.
Stratford, Connecticut

For more information circle **202** on inquiry card.

speeds or timed for CRT photography. **Regular Products**—Recordoscopes.
See ad on page **1262**. Circle **109** on inquiry card.

Arga Div., Beckman Instruments, Inc., South Pasadena, Calif. ... 943
Exhibiting: New Products—Expanded-scale voltmeters; batch weighing device; magnetic mill. **Regular Products**—Synchros; resolvers; signal generator.

Ashton Valve Company, Wrentham, Mass. ... 836
Exhibiting: New Products—Safety valves; with welded inlet, or airlift device for remote operation. **Regular Products**—Safety and relief valves; pressure and vacuum gages; recording gages; gage testers.

Askania Regulator Co., Chicago 11, Ill. ... 601, 603, 605
Exhibiting: New Products—Automatic reversal system for regenerative furnaces; Edgeguide with non-contact sensing nozzles. **Regular Products**—Ratio regulator; pressure transducer; butterfly valve operator; jet pipe principle automatic regulator.
See ads on pages **1238**, **1270**. Circle **75**, **117** on inquiry card.

Assembly Products, Inc., Chagrin Falls, Ohio ... 754
Exhibiting: New Products—Ultrasensitive relay; contact meter-relays; automatic pyrometer with motor-driven interrupter. **Regular Products**—Indicating and non-indicating meter-relays; A.P.I. panel meters; Simplytrol automatic controls.
See ad on page **1233**. Circle **70** on inquiry card.

Associated Research, Inc., Chicago 18, Ill. ... 945
Exhibiting: New Products—Insulation resistance measuring instrument with ranges to 50,000 megohms; a-c. model for production line testing. **Regular Products**—Dielectric testers; insulation resistance and soil resistance and earth resistivity instruments.

Associated Spring Corp., Bristol, Conn. ... 1606
Exhibiting: Springs (compression, extension, torsion, brush, flat, hair, motor, etc.); spring washers; wire forms; metal stampings.

Associated Valve & Engineering Co., Chicago 21, Ill. ... 847, 849
Exhibiting: New Products—Bellows-seal globe, needle, and diaphragm valves; self-draining and packless valves. **Regular Products**—Corrosion-resisting valves and controllers.

Atkomatic Valve Co., Indianapolis, Ind. ... 1145, 1147
Exhibiting: New Products—Semi-direct-lift valves. **Regular Products**—Valves; high-pressure and direct-lift valves.

Atmosphere Control Co., Inc., Philadelphia 43, Pa. ... 1611
Exhibiting: New Products—15-cf atmosphere control cabinet. **Regular Products**—Atmosphere control, temperature, and humidity cabinets; gas transmission cabinets.

Atomic Energy Commission, France (Commissariat A L'Energie Atomique) Paris, France ... 225, 227, 229
Exhibiting: New Products—Nuclear physics instruments; pulse ionization chamber; nuclear targets; compensated neutron-gamma chambers. **Regular Products**—G.M. counters; scalers; coincidence amplifier; square-wave signal generator; G.M. dead-time measurements; d-c. electronic amplifier; vibration reed condenser; air equivalent ionization chambers with pile-electrode; dosimeter electroscope; radioactive aerosol detector; stereoscopic reader for expansion chambers; diffusion chamber; scintillators.

AGASTAT
trademark
pneumatic time delay relays

- Light, versatile, dependable
- Unaffected by voltage variations
- Instantaneous recycling
- Adjustable timing from 0.1 second to 10 or more minutes
- Available in models which offer:

delays on energizing and de-energizing
two step delays
manually actuated time delay switch
remote push button control

***Write** our application engineers for help with your timing problem. Address Dept. A13-89.*

AGA
DIVISION

Elastic Stop Nut Corporation of America
1027 Newark Avenue, Elizabeth, New Jersey
Pioneers in pneumatic timing.

For more information circle **203** on inquiry card.

Automatic Electric Sales Corp., Chicago 7, Ill. ... 715
Exhibiting: New Products—Relays, high-speed polarized 2-position plug-in type, and latch-in type; programmed cam switch relay. **Regular Products**—Relays, and stepping switches, telephone type.
See ad on page **1251**. Circle **92** on inquiry card.

Automatic Steam Products Corp., New York 1, N. Y. ... 1610
Exhibiting: New Products—Water demineralizer; **Regular Products**—Electric steam generator.

Automatic Switch Co., Orange, N. J. ... 911, 913
Exhibiting: New Products—4-way midget solenoid valve for double-acting cylinders; pressure-operated manual reset valves; corrosion resisting valves; close differential relay; electronic relay to demonstrate "Brush Control"; battery charger. **Regular Products**—Valves; electromagnetic controls; switches; contactors; relays.
See ad on page **1217**. Circle **55** on inquiry card.

Automatic Temperature Control Co., Philadelphia 44, Pa. ... 857, 859, 861
Exhibiting: New Products—Reset timer; actuator and valve operator; pneumatic snap-acting limit switch; electro-hydraulic weigh systems. **Regular Products**—Electric and electro-pneumatic sequencing timers; reset timers; valve operators.
See ad on page **1176**. Circle **208** on inquiry card.

Bacharach Industrial Instrument Co., Pittsburgh 8, Pa. ... 342
Exhibiting: New Products—Manometer, U-type, interchangeable scales. **Regular Products**—gas analyzers; temperature and operations recorders; air velocity meter; universal nozzle test stand; diesel and automotive engine and compression testers.

Bailey Meter Co., Cleveland 10, Ohio ... 119, 121, 123
Exhibiting: New Products—Receiver recorder for telemetering systems; transmitters. **Regular Products**—Control systems and components; valves; loaders; relays; switches; pneumatic indicators; gages; recorders; gas analyzer; control drives; Armortube cable.
See ad on pages **1148-1149**. Circle **27** on inquiry card.

Baker Company, Inc., Maplewood, Me. ... 508, 510
Exhibiting: New Products—Bearing torque tester; ultrasonic bearing cleaner and demagnetizer; dust free work bench; space cleaner. **Regular Products**—Bearing assembly tools; pharmaceutical Sterilshields.

Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa. ... 201, 203
Exhibiting: New Products—50-point scanner-recorder; digital printer. **Regular Products**—Weighing demonstration using SR-4 load and pressure cells.
See ad on page **1229**. Circle **67** on inquiry card.

Barksdale-Meletron, Los Angeles 58, Calif. ... 931, 933
Exhibiting: New Products—Stainless, and explosion-proof pressure switches. **Regular Products**—Pressure switches; seal valves; solenoid valves.

Barnes Development Co., Lansdowne, Pa. ... 212
Exhibiting: New Products—Wheatstone sorting bridge and servo balance detector with relay output; deviation bridge. **Regular Products**—Data recorder.

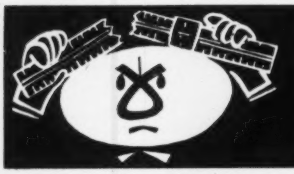
Barton Instrument Corp., Los Angeles 22, Calif. ... 746, 748
Exhibiting: New Products—Pressure transmitter, differential ranges to 0.300 psi, static to 5000 psi. **Regular Products**—Differential pressure units; recorders; indicating flow switch; indicating differential pressure transmitter.
See ad on page **1343**. Circle **183** on inquiry card.

Arnold O. Beckman, Inc., S. Pasadena, Calif. ... 843, 845
Exhibiting: New Products—Dissolved oxygen analyzers. **Regular Products**—Combustion analyzer; high-purity oxygen analyzer; portable analyzer; laboratory and hospital oxygen analyzers.

Beckman Instruments, Inc., Fullerton 1, Calif. ... 935, 937
Exhibiting: New Products—Recording emission spectrophotometer; automatic recording spectrophotometer. **Regular Products**—Industrial pH equipment; colorimeters; ultraviolet spectrophotometer.
See ad on page **1219**. Circle **57** on inquiry card.

Bendix Aviation Corp.: Cincinnati Div., Cincinnati 2, Ohio; Friez Instrument Div., Baltimore 4, Md.; Pacific Div., North Hollywood, Calif. ... 103, 104, 105, 107
Exhibiting: Ultra-Viscoson continuous viscosimeter; mass flow-rate meters; industrial counting system. Humidistat; temperature indicators; thermistors; diaphragms; probes; bellows pressure device; controller for scrubbers, processes, etc.; wind, weather, humidity, and temperature instruments; handle assembly. Digital data-transmission system; radar and telemetering systems; radio control; guidance and servo components; electromechanical accessories; miniaturization.
See ad on page **1161**. Circle **36** on inquiry card.

Benson-Lehner Corp., Los Angeles 64, Calif. ... 1032, 1034
Exhibiting: New Products—Boscar, for analysis of high-speed photography, ballistic films, etc.; Model F, for reading and analyzing data from oscillographs and film records.



I'm through with slide rules!
I'm going to see
Benson-Lehner's data
reduction equipment
in booths **1032** and **1034**.

For more information circle **204** on inquiry card.

Booth No.

Berkeley Div., Beckman Instruments, Inc., Richmond 3, Calif. 939, 941
Exhibiting: New Products—Universal counter and timer, for flow, rpm, temperature and pressure with recorded results in both digital and analog forms; analog computer. **Regular Products**—Decimal counting units; time-interval, and frequency meters; scalers; count-rate meters; double-pulse generators.
See ad on page **1178**. Circle **213** on inquiry card.

James G. Biddle Co., Philadelphia 7, Pa. 711, 713
Exhibiting: New Products—Resonant-reed relays and oscillator controls; motor rotation and phase tester; dielectric test set; impulse cable fault locators; corona test set. **Regular Products**—Insulation and ground testers; ohmmeters; resonant-reed tachometers and frequency meters; tachometers and rheostats.

J. Bishop & Co., Platinum Works, Malvern, Pa. 917, 919
Exhibiting: Small-diameter stainless tubing; platinum and platinum group metals; spinnerettes; fabricated tubular parts.

J. BISHOP & CO.
SPECIALISTS IN MATERIALS FOR CORROSION RESISTANCE
Platinum and Platinum Group Metals
Stainless Steel, Nickel and Nickel Alloy Tubing (.008"-1" O.D.)
Fabricated Tubular Parts
You are cordially invited to visit our Booth #917-919
J. BISHOP & CO. PLATINUM WORKS, Malvern, Pa.
For more information circle **205** on inquiry card.

Black, Sivalls & Bryson, Inc., Kansas City 26, Mo. 125, 127, 129
Exhibiting: New Products—Controller for positive and negative pressures; liquid-level pilot; Saunders patent valve with Climax topworks, back pressure regulator; rupture disks. **Regular Products**—Pressure regulators; valves; controllers; drainers; floats; pump governors; strainers.
See ad on Inside Front Cover. Circle **1** on inquiry card.

Bludworth Marine Division National-Simplex-Bludworth, Inc., New York 39, N. Y. 613
Exhibiting: New Products—Portable survey-type echo depth recorder. **Regular Products**—Radio direction finder and radiophone.

Bodnar Industries, Inc., New Rochelle, N. Y. 928, 930
Exhibiting: New Products—Knobs for Lucite dial skirts. **Regular Products**—Plastic lighting panels and dials in accordance with MIL-P-7788.

Boeing Airplane Co., Seattle 14, Wash. 1010, 1012
Exhibiting: New Products—Analog Computer; electronic function multiplier and generator. **Regular Products**—Analog computer; prepatch receptacle; sequence automatic balance unit.

Bogue Electric Mfg. Co., Paterson 3, N. J. 1417
Exhibiting: 400-cycle laboratory power supplies.

Bopp & Reuther G.M.B.H., Mannheim-Waldhof, Germany 238
Exhibiting: New Products—Oval wheel liquid meters; push button pre-determination type; indicating and recording ring-balance meters; recorders and indicators for flow, pressure and temperature; high-pressure differential manometer; twin-throat Venturi; a-c.-actuated Vibro-mixer; water meters.

Bourns Laboratories, Inc., Riverside, Calif. 655
Exhibiting: New Products—Wire-wound Trimpots; composition resistor and dual Trimpots; high-range differential pressure and miniature and absolute pressure pots. **Regular Products**—Linear-motion, gage pressure, and acceleration pots; trimpot.
See ad on page **1214**. Circle **52** on inquiry card.

Bowser, Inc., Ft. Wayne 2, Ind. 525
Exhibiting: New Products—Flow-rate remote indicator. **Regular Products**—Industrial liquid meters; electromagnetic flowmeter.
See ad on page **1280**. Circle **132** on inquiry card.

Brailsford & Company, Inc., Rye, N. Y. 1005
Exhibiting: New Products—Commutatorless d-c. fractional-watt instrument motor. **Regular Products**—Subminiature instrument motors; fractional-watt sequence timers.

BRAILSFORD & COMPANY INC.
MILTON POINT RYE, N.Y.
ANNOUNCE THE TYPE TR
COMMUTATORLESS D.C. MOTOR
A FRACTIONAL WATT DIRECT CURRENT MOTOR HAVING NO COMMUTATOR, NO CONTACTS, NO SLIP RINGS, NO MOVING CONDUCTORS. CURRENT REQUIREMENT DOWN TO 0.005 AMP. AT 4.0 VOLTS
WILL BE DISPLAYED FOR THE FIRST TIME
AT
BOOTH 1005
For more information circle **206** on inquiry card.

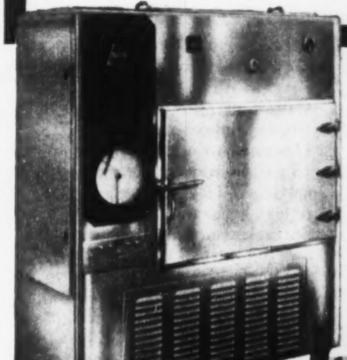
FOR PRECISE AND RELIABLE ENVIRONMENTAL TESTS
AMINCO CLIMATE-LAB
Humidity-Temperature TEST APPARATUS With Program Control

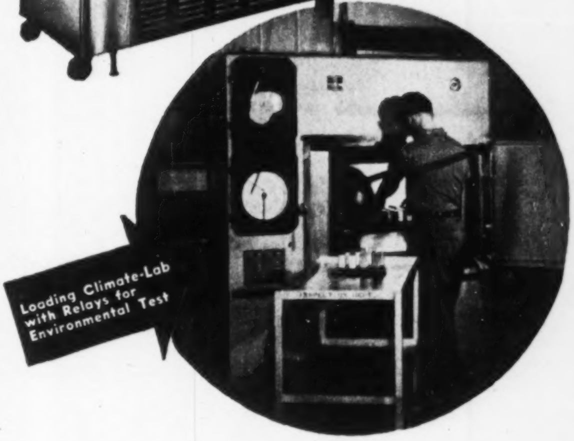
Widely used by industry and government for producing conditions required by U.S. Armed Forces for acceptance testing in accordance with various program schedules.

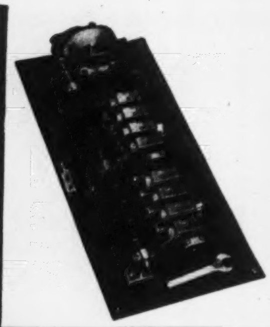
Equally adaptable to atmospheric corrosion studies, development and quality control.

The Climate-Lab is ideal for testing the performance and durability of materials and devices under specific climatic conditions. It consists of a test chamber, air-conditioning unit, and control system, all embodied in a compact unit which affords precisely controlled variations of humidity and temperature repeated periodically according to predetermined programs, and provides a chart record of these variations.

FOUR TYPES OF HUMIDITY-TEMPERATURE CONTROL
1. Constant humidity and constant dry-bulb temperature.
2. Constant humidity and varying dry-bulb temperature.
3. Varying humidity and constant dry-bulb temperature.
4. Varying humidity and varying dry-bulb temperature.
Write for Bulletin 2242-H
AMINCO Laboratory Instruments
AMERICAN INSTRUMENT COMPANY, INC.
Silver Spring, Maryland • In Metropolitan Washington, D. C.
For more information circle **207** on inquiry card.




Loading Climate-Lab with Relays for Environmental Test



positive snap-action
at 1 to 80 psi.

flexible sequence control

dependable, simple, sturdy

atc®

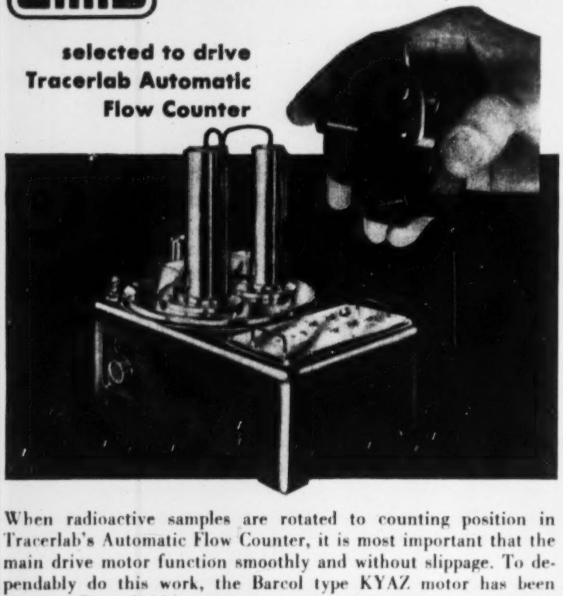
PNEUMATIC
TIMERS

Adjustment and change of sequence or cycle time is easy on ATC Pneumatic Cam Timers, custom-built from standard parts. Designed to operate at 3 to 15 psi. Minimum time setting is 1% of cycle: repeat accuracy, ¼%. Springless poppet—the only moving part of each valve—unaffected by over-pressuring to 100 psi, needs no lubrication. Stop-or repeat-cycle action.

Complete data in Bulletin N-101. Automatic Temperature Control Co., Inc.,
5224 Pulaski Ave.,
Philadelphia 44, Pa.

Represented in Canada by: Powerlite Devices, Ltd., Toronto, Montreal and Vancouver

For more information circle **208** on inquiry card.



BARBER COLMAN

Barcol® Small Motors

selected to drive Tracerlab Automatic Flow Counter

When radioactive samples are rotated to counting position in Tracerlab's Automatic Flow Counter, it is most important that the main drive motor function smoothly and without slippage. To dependably do this work, the Barcol type KYAZ motor has been chosen. For reliable, positive powering of your instruments, too, there's a wide line of high-torque Barcol Small Motors up to 1/30 hp. Unidirectional, reversible, and synchronous. With or without gearing . . . open or enclosed. Write for data sheets.

BARBER-COLMAN COMPANY, Dept. H, 1215 Rock St., ROCKFORD, ILL.

For more information circle **209** on inquiry card.

Booth No.

C. A. Brinkmann & Co., Great Neck, L. I., N. Y. 408
Exhibiting: New Products—Recording micro balance; equipment for paper electrophoresis; exposure meter for photomicrograph; analytical and semi-micro balances. **Regular roducts**—Projection and micro balances; photomicrographic camera; microtomes; microscopes.

Bristol Company, Waterbury, Conn. 732, 734, 736, 738, 740
Exhibiting: New Products—Miniature Metameter receiver; electronic d-c. power supply; potentiometer recorder, indicating pneumatic transmitter; recorder-controller. Miniature indicating potentiometer; unitized pneumatic transmitters, receivers; switches for radar, computer, etc.; diaphragm-type elements for transducers and jet engine controls. **Regular Products**—Transmitter and receiver movements; 270-deg. indicating receiver; wide-strip potentiometer recorder; pressure, and temperature transmitters; indicating and recording receivers; manual automatic control stations; controllers; helical and diaphragm-type pressure elements.
See ad on pages **1121**, **1136-1137**, **1179**.
Circle **6**, **17**, **220** on inquiry card.

Brookfield Engineering Labs., Inc., Stoughton, Mass. 854
Exhibiting: Synchro-Lectric viscometer; Helipath stand; Viscometran; Viscotrol.

If your interests are RHEOLOGICAL
Be *Real Logical* and Visit Us
at the Instrument Show

Brookfield
ENGINEERING LABORATORIES, INC.
STOUGHTON, MASS.

For more information circle **210** on inquiry card.

Brooks Rotameter Co., Lansdale, Pa. 536, 538, 540
Exhibiting: New Products—Rotameter Flow Handbook; pneumatic rotameter transmitter; Flow-mizer; hi/lo flow alarm; armored rotameter; specific gravity indicator; differential-pressure by-pass rotameter; sleeve-type magnetic indicator; **Regular Products**—Rotameters; flow-rate meters; remote recorder-controller and/or integrator.

Brush Electronics Co., Cleveland 14, Ohio 1116, 1118, 1120
Exhibiting: New Products—Rack-mounted multi-channel oscillographs and amplifiers; surface roughness tester. **Regular Products:** Industrial and research instruments; magnetic recording components; piezoelectric materials.
See ad on page **1155**. Circle **31** on inquiry card.

Buehler Ltd.-Amsler, Evanston, Ill. 308, 310
Exhibiting: New Products—Microtesting machines for tensile, shear and bend; specials for wire, strips, textiles, paper, etc. **Regular Products**—Dilatometer; heat microscope; polisher; cut-off machine; spud press, hardness tester; metallograph.

Buffalo Meter Company, Buffalo 14, N. Y. 718
Exhibiting: Meters, volumetric, for almost all liquids.

Builders-Providence, Providence 1, R. I. 805, 807
Exhibiting: New Products—Dall tube, for metering liquid flow; Saran-lined Venturi nozzle. **Regular Products**—Venturi tubes; nozzles; orifice plates; pneumatic, mechanical and electrical instruments; control panels; scales; pumps; blenders; feeders.
See ad on pages **1177**, **1282**. Circle **211**, **135** on inquiry card.

Burgess Battery Company, Freeport, Ill. 457
Exhibiting: New Products—Transistor power supplies; subminiature cells and batteries; reserve-type power packs. **Regular Products**—dry batteries; reserve batteries.

Burling Instrument Co., Chatham, N. J. 417
Exhibiting: New Products—Explosion-proof temperature and limit switch for use to 1000 F.; **Regular Products**—Temperature controls.

Burroughs Corp., Electronic Instruments Div., Philadelphia 7, Pa. 1022, 1024
Exhibiting: New Products—Variable pulse scaler; standardizing sequence gater; magnetic shift register; tape-wound magnetic cores. **Regular Products**—Unitized pulse control equipment; beam switching tubes.
See ad on page **1234**. Circle **71** on inquiry card.

Burton Mfg. Co., Los Angeles 64, Calif. 1714
Exhibiting: New Products—Electronic dew-point hygrometer, micro viscosimeter; high-speed dental motor; ultraviolet lights; absolute pressure gage; zirconium arc lamp. **Regular Products**—Illuminated magnifiers; microscope illuminators; pipette shakers; criminology kit.

J. A. Campbell Co., Long Beach 7, Calif. 1511
Exhibiting: Thermometer wells; corrosion detectors; gas samples; gage stripping; pulsation dampers, etc.

Cambridge Instrument Co., Inc., New York 17, N. Y. 218, 220
Exhibiting: Surface pyrometers; moisture, aero mixture indicators; exhaust gas testers; gas analysis indicators, recorder; pH meters; fabric permeameter; electrometer; ionization meter; galvanometers; fluxmeter; cardioscopes; electro-cardiographs; multi-channel recorder.
See ad on page **1181**. Circle **225** on inquiry card.

Capehart-Farnsworth Co., Fort Wayne 1, Ind. 654
Exhibiting: New Products—Closed-circuit TV system with remote controls; storage type cathode-ray tube for daylight viewing radar indicators; radar calibrator. **Regular Products**—Image dissector tube.
See ad on page **1331**. Circle **168** on inquiry card.

Cargo Packers, Inc., Brooklyn 11, N. Y. 256
Exhibiting: New Products—Packaging delicate electronic items for shock and climatic requirements. **Regular Products**—Packaging materials and service.

Booth No.

CEC Instruments, Inc., Subsidiary of Consolidated Engineering Corp., Pasadena 15, Calif. 624, 626, 628, 630
Exhibiting: New Products—Pressure measuring system with digital indication; four-channel carrier amplifier; mass spectrometer helium leak detector; digitizing systems; transducers; power supply. **Regular Products**—Oscillographs; pickups; portable titrilog; mass spectrometer; oscillogram processor; galvanometers; SADIC; vibration meter; bridge balance.

Central Scientific Co., Chicago 13, Ill. 1002, 1004
Exhibiting: Selective experiments in Physics; optical benches, accessories, vacuum couplings, connectors; oil diffusion pumps; compound water purifier.

Century Geophysical Corp., Tulsa, Okla. 936, 938
Exhibiting: New Products—Multi-channel recording oscillograph; electronic 12-channel unit switch. **Regular Products**—Multi-channel recording oscillograph; carrier, and linear integrating, amplifiers; miniature galvanometers; associated equipment.

Chapman Laboratories, West Chester, Pa. 307
Exhibiting: 10-in. field photoelastic polariscope with integral interferometer; photoelastic model making kits; macro camera.

John Chatillon & Sons, New York 38, N. Y. 424
Exhibiting: New Products—Push-pull gages; instrument scales for tension or torque testers; torsion testers; Spring torsion and tension testers. **Regular Products**—Precision springs of all types.
See ad on page **1209**. Circle **47** on inquiry card.

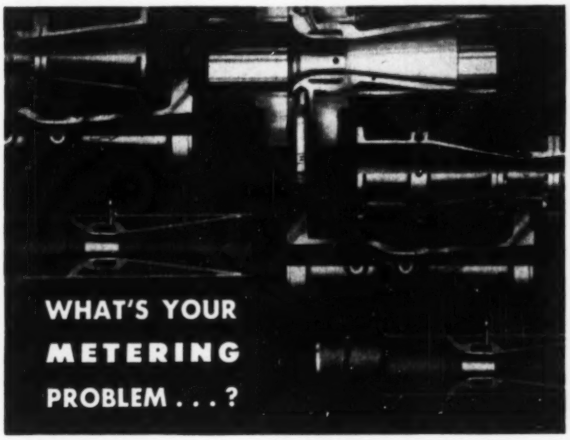
Chemiquip Co., New York 12, N. Y. 921
Exhibiting: New Products—Sealed system snubber. **Regular Products**—Porous metallic pressure snubbers; mercury traps.

C. P. Clare & Co., Chicago 45, Ill. 348
Exhibiting: New Products—High-frequency impulse relay; high-temperature relays; shock and vibration relays. **Regular Products**—Relays; switches; keys.
See ad on page **1227**. Circle **65** on inquiry card.

Commercial Research Labs., Inc., Detroit 3, Michigan 435, 437
Exhibiting: Flowmeters; flowmeter calibrating stands; engine indicators; fuel nozzle, and carburetor test stands; magnetic thickness gages; electronic instruments.
See ad on Inside Back Cover. Circle **196** on inquiry card.

Computer Company Div., Bruno-New York Industries Corp., New York 1, N. Y. 309
Exhibiting: New Products—Differential analyzer with 24 stabilized amplifiers and up to 10 integrators; null-type d-c. voltmeter; d-c. voltmeter; function generator; unitized power supplies; close-control relay; r-f. power meters; Loran receiver test set. **Regular Products**—Computer Model ESR-2; non-linear unit; multimeter; bolometers.

Conax Corp., Buffalo 21, N. Y. 460, 462
Exhibiting: New Products—Surface-temperature thermocouple; electrode gland; high-pressure thermocouple gland; lava sealant. **Regular Products**—Thermocouple glands, tubes, assemblies.
See ad on page **1180**. Circle **222** on inquiry card.



BUILDERS can help you, whether your metering problem involves slurries, corrosive fluids, collodial solutions, trade wastes, air, steam, gases, or water. High pressures, high temperatures, minimum pressure losses — these and other job conditions are readily solved by Builders Flow Nozzles and Tubes. Our standard designs answer all types of metering requirements. Units are available in special metals or with Saran lining for corrosive applications.

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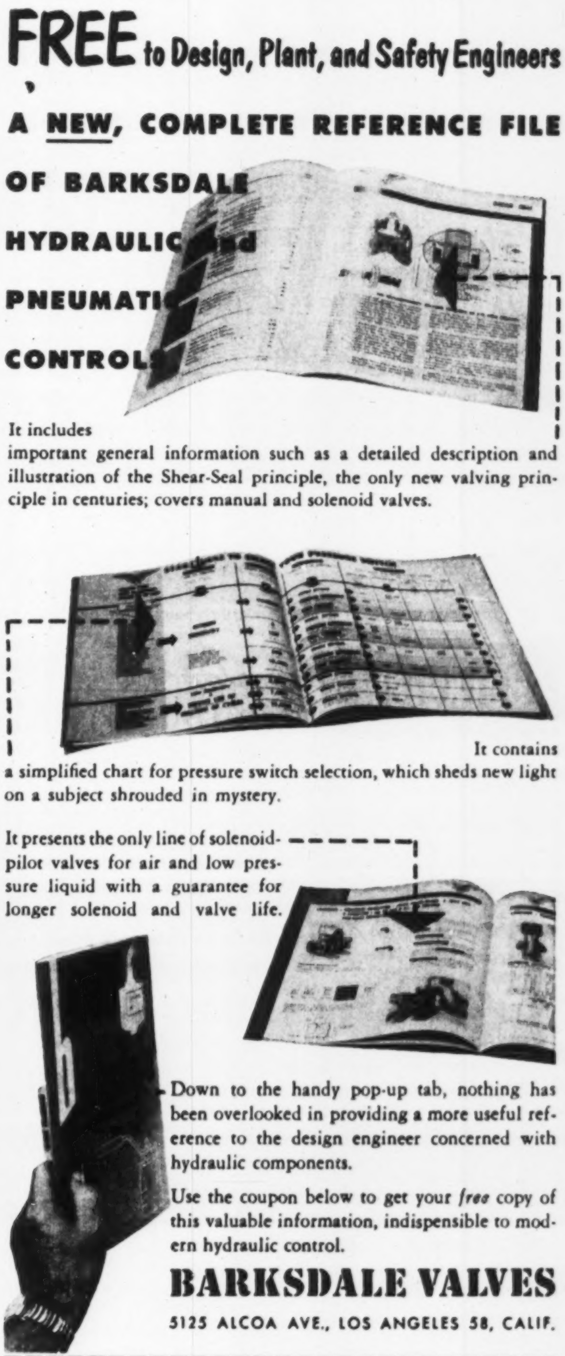
DIVISION OF B-I-F INDUSTRIES, INC.
METERS FEEDERS CONTROLS

For more information circle **211** on inquiry card.



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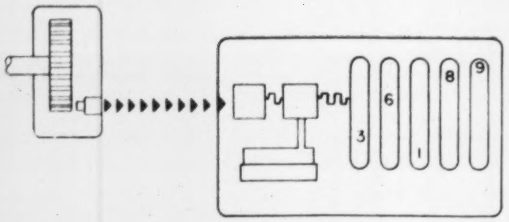

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FEATURES—

- Accuracy ± 1 r.p.m. for any reading
- Range 0 to 100,000 r.p.m.
- Direct digital reading in r.p.m.
- Designed for production use
- Self-testing in 2 seconds
- Does not require mechanical connection to rotating part
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Complete application data on request; write for details.

Berkeley *division* M-28
BECKMAN INSTRUMENTS INC.
Dept. B8 2200 Wright Ave., Richmond, Calif

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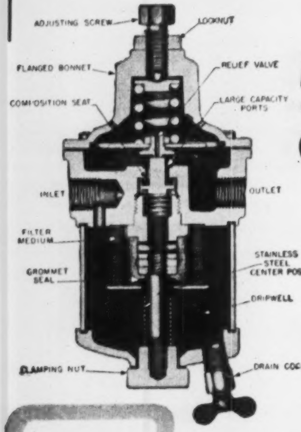

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CONO AIRPAK

—REGULATES

—FILTERS

IN A SINGLE UNIT

The advantages of a high quality large capacity reducing valve with safety relief, and an efficient air filter, are combined in a single compact unit. Save space and installation costs by eliminating the use of separate units. Pressure gauge can be mounted integrally. Construction is rugged, corrosive resistant and long lasting. Available in a variety of ranges and dripwell capacities for production equipment, instruments and controls, spraying equipment, and pneumatic gauges. Write for BULLETIN H-1 to get full details.

CONOFLOW CORPORATION
2100 ARCH ST.
PHILADELPHIA 3, PA.

Cono-Controls

CC-116

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Conoflow Corp., Philadelphia 3, Pa. 631, 633, 635
Exhibiting: New Products—Representative designs, Cono LB valves; air filter and redesigned Airpak and regulators. **Regular Products**—Valves; cylinder operators; instrument-type differential, and vacuum regulators; purge assemblies; ratio and reversing relays.
See ad on page **1178**. Circle **214** on inquiry card.

Continental Equipment Co., Coraopolis, Pa. 616, 618, 620, 622
Exhibiting: New Products—Pressure-sealed, and motor-operated butterfly valves. **Regular Products**—Manual, electric, pneumatic, hydraulic operated butterfly valves.

CONTINENTAL

BUTTERFLY CONTROL VALVES

CONTINENTAL EQUIPMENT COMPANY
CORAOPOLIS, PA.

For more information circle **215** on inquiry card.

Control Engineering Corp., Norwood, Mass. 1050, 1052, 1054
.... 1056, 1058
Exhibiting: New Products—Inertial mass flowmeter; Electro-Syn pressure and temperature remote indicators and recorders. **Regular Products**—Engine pressure transducers.

Control Products, Inc., Harrison, N. J. 354
Exhibiting: New Products—Hermetically-sealed aircraft switches; snap-action thermal switches. **Regular Products**—Sensitive waterproof switches; thermal devices.

Cook Electric Co., Chicago 14, Ill. 840
Exhibiting: New Products—Counterpoise relay; automatic ice detection systems. **Regular Products**—Relays; switches; bellows; laminated plastics; electronic systems.
See ad on page **1212**. Circle **50** on inquiry card.

Cosa Corp., New York 17, N. Y. 516
Exhibiting: New Products—Heat-flow factor recorder for combustible gas. **Regular Products**—Btu. recording-controlling calorimeters; comparators; bench micrometers; toroidal coil winding machine.

visit COSA booth 559

and see SIGMA
Recording Calorimeters
Density Recorders
Heat Flow Factor Recorders
Water Flow Calorimeter
and Precision Measuring Equipment

and MICAFIL
Toroidal Coil Winding Machine

For more information circle **216** on inquiry card.

Cox & Stevens, Mineola, N. Y. 1814, 1816
Exhibiting: Electronic motor truck and railroad weighing scales.

Cox & Stevens Aircraft Corp., Mineola, N. Y. 1818
Exhibiting: New Products—Electronic load-cell calibration kit. **Regular Products**—Industrial electronic scales; truck overload detectors; aircraft electronic weighing kits and load adjuster; navigational computers; power indicator; flight coordinator.

R. W. Cramer Co., Inc., Centerbrook, Conn. 443, 445
Exhibiting: New Products—New design synchronous motor. **Regular Products**—Synchronous motors; timers; relays; running time meters.
See ad on page **1180**. Circle **221** on inquiry card.

Crawford Fitting Co., Cleveland 10, Ohio 704, 706
Exhibiting: New Products—New variation of Swagelok tube fittings; quick connectors; small size tube fittings. **Regular Products**—Tube fittings.
See ad on pages **1130-1131**. Circle **13** on inquiry card.

Enjoy FREE bus service
between your hotel and Convention Hall.
Courtesy—
Swagelok® **CRAWFORD FITTING CO.**
884 E. 140th Street, Cleveland 10, Ohio

For more information circle **217** on inquiry card.

Crescent Insulated Wire & Cable Co., Trenton 5, N. J. 340
Exhibiting: Armored multitube, cabled tubes protected by flexible steel armor, or corrosion-resistant thermosplastic sheet, or both.
See ad on page **1167**. Circle **42** on inquiry card.

Crosby Steam Gage & Valve Co., Wrentham, Mass. 836
Exhibiting: New Products—Safety valves: with welded inlet, or air-lift device for remote operation. **Regular Products**—Safety and relief valves; gages; gage testing equipment.

Booth No.

Curtis Wright Corp., Electronic Div., Carlstadt, N. Y. 240
Exhibiting: New Products: Scaler-ratemeter for Geiger counters; proportional and scintillation counters; rate and survey meter; swinging condenser electrometer; beta gamma thickness gages. **Regular Products**—Beta thickness gages.

Cybertronic Corp. of America, Chester, Pa. 1042
Exhibiting: New Products—Electronic pyrometer controller; millivoltmeter pyrometer. **Regular Products**—Temperature controller; pocket pyrometer with various thermocouples; millivoltmeter pyrometers.
See ad on pages **1185, 1345**. Circle **242, 194** on inquiry card.

George W. Dahl Co., Inc., Bristol, R. I. 960, 962
Exhibiting: New Products—Packless control valves; demi valves; pneumatic and hydraulic diaphragm operators; valve manifolds; miniature diaphragm valves; manual-reset operators; tubing and pipe couplings. **Regular Products**—Valves; Teflon products.
See ad on page **1182**. Circle **226** on inquiry card.

Daniel Orifice Fitting Co., Houston 20, Tex. 223
Exhibiting: New Products—Flow tubes for small orifice. **Regular Products**—Orifice fittings, plates, and plate holders; saddles; fabricated meter runs; straightening vanes; check valves.
See ad on page **1264**. Circle **111** on inquiry card.

Daven Company, Newark 4, N. J. 405
Exhibiting: New Products—Encapsulated wire-wound resistors; subminiature resistors and rotary ceramic switches. **Regular Products**—Attenuators; potentiometers; resistors; switches; vacuum-tube voltmeters; transmission measuring sets; output power meters; decade voltage dividers.

Davies Laboratories, Inc., Riverdale, Md. 853
Exhibiting: New Products—Airborne magnetic tape recorder; magnetic tape reproducer for playback. **Regular Products**—Analog computer.

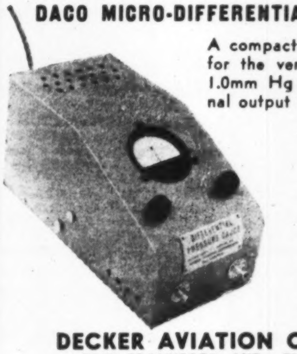
Davis Instruments, Div. of Davis Emergency Equipment Co., Newark 4, N. J. 423, 425
Exhibiting: New Products—Oxygen analyzer; odortester, for determination of odorant in natural gases. **Regular Products**—Combustible gas alarm systems; electro-, and thermal-conductivity analyzers; vapor testers; halide meter.
See ad on page **1321**. Circle **156** on inquiry card.

Daystrom Instrument, Archbald, Pa. 547, 549
Exhibiting: New Products—Transistor magnetic amplifier. **Regular Products**—Precision potentiometers.
See ad on page **1249**. Circle **89** on inquiry card.

Decade Instrument Co. (See Kay Electric Co.) 1605

Decker Aviation Corp., Philadelphia 25, Pa. 1710
Exhibiting: New Products—Micro-differential pressure gage; electronic microcomparator; liquid-level gaging system; acceleration pickups.

DACO MICRO-DIFFERENTIAL PRESSURE GAUGE



A compact, portable pressure gauge for the very low range of 10^{-3} to 1.0mm Hg differential pressure. Signal output for oscilloscope indication or recording of dynamic phenomena in addition to a direct reading meter which covers the full range in three scales. 0-50, 0-250, 0-1000 Microns Hg. Linearity ±2% on all scales. No accessory equipment needed. Power requirement 115V, 60cps, 35VA.

DECKER AVIATION CORPORATION
1361 FRANKFORD AVE., PHILADELPHIA, PA.

For more information circle **218** on inquiry card.

Devicengineering Co., Philadelphia 3, Pa. 504
Exhibiting: Selected products of Research Controls Co., and John R. Monsell Co.

De Zurik Shower Co., Sartell, Minn. 905
Exhibiting: Valves.

Diamond Power Specialty Corp., Lancaster, Ohio 648
Exhibiting: New Products—Industrial TV camera, operating either studio monitor or commercial receiver. **Regular Products**—Industrial TV equipment.

Dekoron Products Div., Samuel Moore & Co. Mantua, Ohio 820, 822
Exhibiting: New Products—Coated ribbon, plastic and metal tubes; tube clamps. **Regular Products**—Coated metal and plastic instrument tubing; tube fittings; valves; junction and union boxes.
See ad on page **1279**. Circle **131** on inquiry card.

BOOTHS 820-822

Dekoron® products

quality
research
service

SAMUEL MOORE & COMPANY - MANTUA, OHIO
DEKORON PRODUCTS DIVISION

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Need instrument charts?

If you do, it makes sense to get them from a firm familiar with instrumentation problems. That's us.

We're not only instrument makers, we're one of the largest chart printers in the country — with 65 years of experience in printing precision instrument charts.

We've recently expanded our engineering and production facilities for printing recorder charts for other instrument companies to their specifications. Now we can supply circular charts up to 12 inches in diameter and strip charts up to 29⅝ inches wide for all types of special instruments, including research, industrial, test, analytical, scientific, laboratory and pilot plant instruments and computers.

In addition, special papers for dry recording, such as wax coated, heat sensitive, chemically coated and electrically sensitive papers, can be handled on our new equipment.

Our engineering service has also been expanded to help instrument builders develop charts best suited for their particular needs.

Write for free bulletin describing and picturing our chart production facilities. The Bristol Company, 113 Bristol Road, Waterbury 20, Conn.

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Points the Way in Human-Engineered Instrumentation

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

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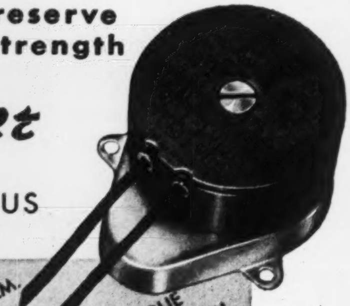
SYNCHRONOUS
MOTOR



POWERFUL
HIGH TORQUE
30 IN. OZ. AT 1 R.P.M.
TRULY SYNCHRONOUS
WIDE RANGE OF SPEED
RIGHT OR LEFT ROTATION. HIGH TORQUE
INSTANT START AND STOP. RESERVE STRENGTH
RUNS IN ANY POSITION. COMPACT DESIGN
WIDE VARIETY OF OUTPUT SHAFTS. POWERFUL
ONE OR TWO-WAY FRICTION. ADAPTABLE
RUGGED. PRECISION-CUT GEARS
LUBRICATED FOR LIFE

Write today...
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SPECIALISTS IN TIME CONTROL
The R. W. CRAMER CO., Inc.
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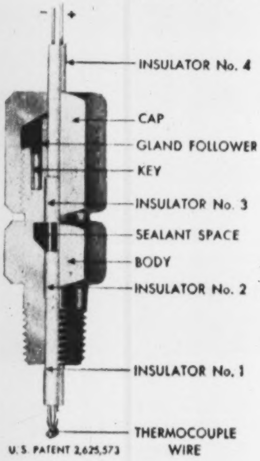
CONAX
BARE WIRE AND QUICK DISCONNECT
THERMOCOUPLES



Cross Section of Bare Wire Type

Quick Disconnect Type

Greater *Speed* and *Accuracy* of temperature sensing is provided by the exclusive features of Conax Patented Bare Wire Thermocouple Glands. Pressures range from full vacuum to 15,000 psi. and temperatures range from −300°F. to +2000°F. Stainless steel construction . . . small . . . compact size.

Also complete line of Packing Glands and Shielded Thermocouples.

Write today for fully illustrated, complete Conax Catalog.

See Complete Line of CONAX Products in Booths 460, 462 at the Instrument Show in Philadelphia.

CONAX
CORPORATION
4515 MAIN STREET
BUFFALO 21, N.Y.

For more information circle **222** on inquiry card.

Booth No.

William Dixon, Inc., Newark, N. J. 1612
Exhibiting: Fine tools, tweezers, calipers, gages, rules, pliers, etc.

DoAll Co., Des Plaines, Ill. 143
Exhibiting: New Products—B & L optical inspection equipment. **Regular Products**—Gage blocks; mobile inspection unit; monolight and optical flats; comparators; micrometers; tool-room instruments and equipment.

Doelcam Corp., Boston 35, Mass. 1717
Exhibiting: New Products—D-c. indicating amplifiers; viscosimeter; microreceiver for energizing transducers, measuring transducer signal; null-balancing a-c. position servo indicator. **Regular Products**—Gyros; synchros; servomotors; microsyn position indicators; servomechanisms; flight-test equipment.
See ad on page **1239**. Circle **76** on inquiry card.

Driver-Harris Co., Harrison, N. J. 559, 561
Exhibiting: New Products—Glass-to-metal sealing alloy; **Regular Products**—Nichrome; Nichrome V; Advance; Manganin; Karma.

SPECIAL PURPOSE ALLOYS SINCE 1899
D/H
TRADE MARK REG. U. S. PAT. OFF.
Driver-Harris
INSTRUMENT ALLOYS
include:
KARMA® NICHROME®
ADVANCE® MANGANIN

For more information circle **223** on inquiry card.

Durant Mfg. Co., Milwaukee 1, Wis. 852
Exhibiting: New Products—Electric predetermined counter; double-bank shutter counter; tape recorder counter. **Regular Products**—Instrument indicating counters.
See ad on page **1184**. Circle **238** on inquiry card.

F. W. Dwyer Mfg. Co., Chicago 12, Ill. 553
Exhibiting: Inclined and vertical manometers; pressure switches; flowmeters; gas analyzers; air filters; gages; pitot tubes; pointer-type low-pressure gages.

Eagle Signal Corp., Moline, Ill. 944
Exhibiting: New Products—Airflex timer; multipulse timer; step switch; count interval timer. **Regular Products**—Timers; impulse counters; interrupter; etc.
See ad on page **1232**. Circle **69** on inquiry card.

Eastern Precision Resistor Corp., Richmond Hill, N. Y. 1517
Exhibiting: New Products—5-place Wheatstone bridge accurate to 0.05%. **Regular Products**—Precision wire-wound resistors; power supplies; Wheatstone bridges; resistance standards.

Eastman Kodak Co., Rochester 4, N. Y. 1039, 1041
Exhibiting: New Products—Ektron detectors (lead sulphide cells); Linagraph 1127 paper. **Regular Products**—Linagraph materials; spectroscopic plates and films.

Edin Company, Ltd., Worcester, Mass. 1616
Exhibiting: New Products—Recorders with instant shift, nine chart speeds. **Regular Products**—Galvanometers; amplifiers; recording equipment.

Thos. A. Edison, Inc., Instrument Div., West Orange, N. J. 518
Exhibiting: New Products—Continuous temperature monitoring system. **Regular Products**—Resistance temperature detectors; microampere and time delay relays; thermostatic controls.
See ad on page **1267**. Circle **114** on inquiry card.

Edmund Scientific Co., Barrington, N. J. 1027, 1029
Exhibiting: Pocket comparator; stereo, pocket and standard microscopes; telescopes; binoculars; lenses, prisms, optical glass; optical components; scientific toys.
See ad on page **1184**. Circle **237** on inquiry card.

Electric Auto-Lite Co., Toledo 1, Ohio 330
Exhibiting: New Products—Recording thermometer with self-contained capillary tubing. **Regular Products**—Recording thermometers, vacuum and pressure gages; transformer thermometers; thermal relays; dial indicating thermometers.
See ad on pages **1187**, **1276**. Circle **251**, **127** on inquiry card.

Electric Regulator Corp., Norwalk, Conn. 1155
Exhibiting: New Products—Air damping dashpot for control mechanisms and switchgear; miniature rheostat for high-temperature operation. **Regular Products**—Voltage speed and current regulators; servo controls.

Electro-Data Corp., Pasadena 6, Calif. 1810
Exhibiting: New Products—Magnetic tape unit. **Regular Products**—Electronic data-processing system.

Electro-Mec Lab., Inc., Long Island City 1, N. Y. 951
Exhibiting: Ultra-low-torque precision potentiometers; accuracies better than 0.1%, sizes from ⅞-in. to 3-in. diam.

Electronic Associates, Inc., Long Branch, N. J. 1154, 1156
Exhibiting: General- and special-purpose analog computers; plotting boards; precision wire-wound potentiometers.

Electronic Signal & Instrument Co., Meriden, Conn. 1814, 1816
Exhibiting: New Products—Automatic cash totalizer; automatic toll taker. **Regular Products**—Highway toll equipment; electromechanical components.

Electronic Tube Corp., Philadelphia 18, Pa. 210
Exhibiting: New Products—Strainalyzer, for measurement of stress and strain from DC to 200 kilocycles. **Regular Products**—Multi-channel oscilloscopes; d-c. amplifiers; multi-gun cathode ray tubes.

Electro-Snap Switch & Mfg. Co., Chicago 24, Ill. 1238
Exhibiting: Hermetically-sealed limit switch; one-way impulse die-

Booth No.

cast switch; standard basic switches; subminiature switches; industrial limit switches.
See ad on page **1187**. Circle **250** on inquiry card.

Elgin Metalformers Corp., Elgin, Ill. 948, 950
Exhibiting: New Products—Encor enclosure system with cabinets, consoles, racks; component parts for custom built requirements.

Ellison Draft Gage Co., Inc., Chicago 6, Ill. 422
Exhibiting: Draft gages; U-path steam calorimeters; pitot tubes; portable gas analyzers.
See ad on page **1186**. Circle **244** on inquiry card.

El-Tronics, Inc., Philadelphia 23, Pa. 349
Exhibiting: Electronic test equipment; nuclear instrumentation.

A. H. Emery Co., New Canaan, Conn. 855
Exhibiting: New Products—Hydraulic tank weighing equipment; platform scale; crane scales (precision). **Regular Products**—Hydraulic load cells; load indicators; hydraulic weighing systems.
See ad on page **1283**. Circle **137** on inquiry card.

Encyclopaedia Britannica, Chicago, Ill. 851

Energy Control Corp., Philadelphia 32, Pa. 515
Exhibiting: Sectional plastic model of Jersey Central Power and Light Co. plant showing all instruments and controls supplied by Energy Control.

Chas. Engelhard, Inc., Newark 5, N. J. 353
Exhibiting: Transfer volt-ammeter; Universal gas analyzer; W1 indicator; flue and exhaust gas analyzers; thermocouples; resistance thermometer spiral.

Ess Instrument Co., Bergenfield, N. J. 514
Exhibiting: New Products—Potentiometer smoke recorder. **Regular Products**—Air conditioning smoke detector; flame safeguard; Wyd-angle periscope; Hazegage indicator; combustion controller.

Esterline Angus Co., Inc., Indianapolis 6, Indiana 923
Exhibiting: A-c. recording wattmeter; speed recorder; contact-making meter; tachometer generator; d-c. milliammeter; 20-pen operation recorder; current transformer; chart drives.

Evershed & Vignoles, Ltd., London, England 811, 813
Exhibiting: Electronic process control equipment; flow, pressure, level and temperature measuring elements; remote indication and control equipment; oil storage tank gages.

Fairbanks, Morse & Co., Davenport, Iowa 1719, 1721

Falstrom Company, Passaic, N. J. 651, 653
Exhibiting: New Products—Aluminum console, formed construction. **Regular Products**—Instrument, boiler, and gage boards; control panels and cubicles; turbine boards; housings.
See ad on page **1118**. Circle **3** on inquiry card.

Farris Engineering Corp., Farris Flexible Valve Corp., Farris Stacon Corp., and Farris Pickering Governor Co., Palisades Park, New Jersey 522, 554, 556
Exhibiting: Safety and relief valves for process and power house applications; rubber pinch valves; temperature regulators; hydraulic, mechanical, and ball ranger governors.
See ad on pages **1128-1129**. Circle **12** on inquiry card.

J. W. Fecker, Inc., Pittsburgh 14, Pa. 1508
Exhibiting: New Products—14-ft. f-10.5 collimator; astronomical telescope; 40-in. f-6.3 high resolution lens. **Regular Products**—Optical elements.

An Invitation
to visit us at the
FIRST
International Instrument
Exposition
Booth 1508

j. w. Fecker, inc.
2016 Perrysville Ave., Pittsburgh 14, Pa.

For more information circle **224** on inquiry card.

Federal Telephone & Radio Div., International Tel. & Tel. Corp. Clifton, N. J. 202, 204
Exhibiting: New Products—Capacitors; HF attenuators; insulation resistance testers; galvanometers with photographic recorder; CR-oscillator; automatic Smith diagram plotter; instruments for measurement of frequency, resistance, inductance.
See ad on page **1169**. Circle **44** on inquiry card.

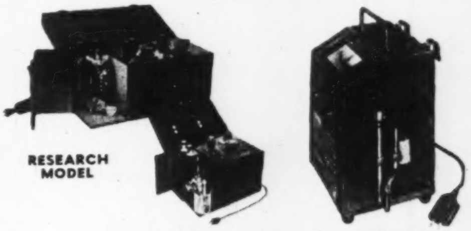
Fenwal Incorporated, Ashland, Mass. 828, 830
Exhibiting: New Products—Miniature (-20 to 275 F.) and midget

CAMBRIDGE
PRECISION INSTRUMENTS
FOR EXACTING PROFESSIONS AND INDUSTRIES

In the past half-century, many important developments of science and industry have been furthered by use of Cambridge Instruments. From its inception, this Company has made precision instruments for exacting professions and industries. Some of the

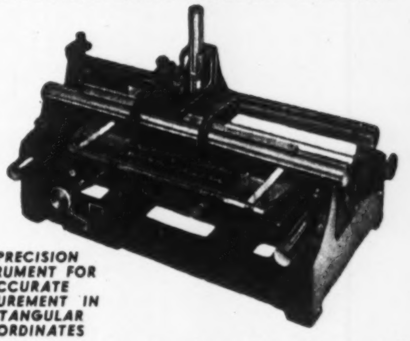
Size:
8.3 x 6.5 x 3.5 cm.
Weight: 0.17 Kg

LINDEMAN-RYERSON ELECTROMETER
This instrument is extensively used for the determination of radioactive emission. Has high sensitivity, good stability and does not require leveling. Send for descriptive literature.



pH METERS.
The three portable models shown incorporate new and important advantages. AC line operation eliminates battery nuisance. Laboratory and Research Models use electron-ray tubes for precise null-point indication. Industrial model is direct-reading, continuous-indicating; ruggedly built for plant use.

CAMBRIDGE UNIVERSAL MEASURING MACHINE


A PRECISION INSTRUMENT FOR ACCURATE MEASUREMENT IN RECTANGULAR CO-ORDINATES

This instrument measures, in rectangular co-ordinates, records, diagrams or photographic prints, films, or plates. It is suitable for checking reseau, the dividing of scales, pitch of micrometer screws, etc. Magnification x 12.

CAMBRIDGE ALSO MAKES
Moisture Indicators and Recorders, Aero Mixture Indicators, pH Meters and Recorders, CO_2 and Multi-Gas Analyzers and Recorders, Geophysical Seismographs, Electrometers, Voltamographs, Galvanometers, Dissolved Oxygen Recorders, Fabric Permeameters, Exhaust Gas Testers, Surface Pyrometers, Fluxmeters, Vibrographs, Stethographs, Electrocardiographs and instruments for measuring radioactive emission.

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New York 17, N. Y.
PIONEER MANUFACTURERS
OF PRECISION INSTRUMENTS

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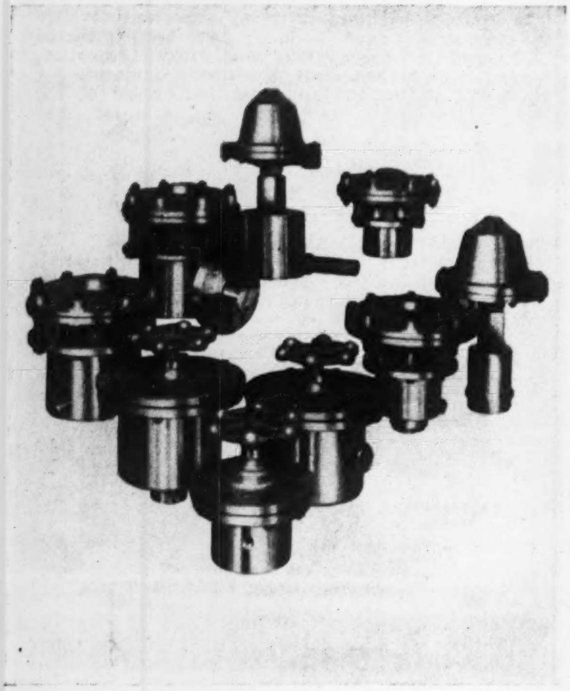
A. E. C. APPROVED



WHAT ARE THEY?

Barstock, packless valves for corrosive service shown with integral tubing connections, pipe threads and flanged ends.

WHAT WILL THEY DO?

Control flows by manual or remote operation.

WHERE CAN THEY BE USED?

Wherever process demands exacting qualities such as: resistance to corrosion, either quick opening or throttling characteristics, where space is a factor, and in all instances for low maintenance costs.

These are but a few of the varied designs which you can see at our booths #960 and #962 in the coming Instrument Show at Philadelphia in September.

Manufacturers of the Demi ® Line

Mfg. in U.S.A.

George H. DAHL
BRISTOL, RHODE ISLAND

For more information circle **226** on inquiry card.

(–50 to 450 F.) temperature controls; air flow or liquid level detector; thermoswitch control. **Regular Products**—Thermostats.

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Four NEW Fenwal Products

At the Philadelphia Instrument Show four entirely new products developed by Fenwal Incorporated will be shown for the first time. Be sure to see them at the Fenwal booths 828 and 830.

Fenwal
Incorporated
ASHLAND, MASS.

Electric Temperature Control And Detection Devices

For more information circle **227** on inquiry card.

Fielden Instrument Div., Robertshaw-Fulton Controls Co., Philadelphia 33, Pa. 722, 724
Exhibiting: New Products—D-c. amplifier; electronic temperature controller; r-f. capacitance bridge; scanning system for temperature, pressure, etc. **Regular Products**—Electronic level controllers and indicators; multi-point recorders.

T. R. Finn & Company, Inc., Hawthorne, N. J. 449
Exhibiting: New Products—All-metal vibration isolators. **Regular Products**—Aluminum, glass-fibre and magnesium bases for airborne electronic equipment; shock and vibration control equipment.

Fischer & Porter Co., Hatboro, Pa.
.... 1136, 1138, 1140, 1142, 1144, 1146
Exhibiting: New Products—Low-cost mechanical digitizer; data reduction systems; glass separatory funnel; high-torque absolute pressure gage; miniature tape-scale meter; propeller meter. **Regular Products**—Instrumentation for flow, level, pressure, temperature, viscosity and density; control valves; chlorinators; chemical feeders.
See ad on page **1166**. Circle **41** on inquiry card.

Fisher Governor Co., Marshalltown, Iowa 619, 621, 623
Exhibiting: New Products—Non-catalyst injection valve; reactor valve; 2500-psi. bodies with pressure seals; steam jacket valve bodies. **Regular Products**—Pressure pilots, liquid level controllers; diaphragm motor valves; positioners.
See ad on page **1133**. Circle **14** on inquiry card.

Flexonics Corp., Maywood, Ill. 650, 652
Exhibiting: New Products—Thin-wall stainless steel tubing. **Regular Products**—Bellows; expansion joints; metal hose; capillary casing.

Foster Engineering Co., Union, New Jersey 517, 519
Exhibiting: Flow tubes; safety valves; regulating valves.
See ad on page **1274**. Circle **124** on inquiry card.

Foxboro Company, Foxboro, Mass.
....1202, 1204, 1206, 1208, 1210, 1212, 1214, 1216, 1218, 1220
Exhibiting: New Products—Electromagnetic flowmeter; EMF-to-air transmitter; cell transmitter; time-impulse telemetering system; resistance-type Dynalog; temperature transmitter; Consotrol recorder; pressure-measuring elements; temperature-measuring elements for filled systems. **Regular Products**—Control valves and auxiliary devices; graphic panel instruments, indicators, recorders, and controllers; orifice plates; heavy-duty helical pressure elements; flowmeters.
See ad on pages **1126, 1186.** Circle **11, 245** on inquiry card.

George E. Fredericks Co., Bethayres, Pa. 925
Exhibiting: Vacuum measuring equipment; precision-bore glass tubing; scientific glassware; metallizing on glass.

French Consolidated Exhibit
......1043, 1045, 1047, 1049, 1051, 1053, 1055, 1057, 1059, 1061

Chauvin-Arnoux, Paris 18e. Exhibiting: Pyroptic, Cellophat, Polycon, Neo-Super.

Renault, Paris Exhibiting: New Products—Reclining spectacles, crown prism mounts; magnifying spectacles for delicate work; amblyopia spectacles.

La Precision Mecanique, Paris, Exhibiting: New Products—Electric and electronic measuring devices. **Regular Products**—Standard and special dimensional gages.

Optique et Precision de Levallois, Paris IXe. Exhibiting: New Products—Precision measuring instruments. **Regular Products**—Universal microscope; refractometers; optical dividers; micrometric readers; optico-mechanical and metrology devices.

S. A. Jules Richard, Paris 19e. Exhibiting: New Products—Recording and dial manometers; thermometers; hygrometers. **Regular Products**—Aerial photography; medical apparatus, reanimator, kymographic insufflator.

Societe Anonyme Ateliers L. Doignon, Melakoff (Seine). **Exhibiting: New Products**—X-Y recorder; Charron's unctuosimeter and frictometer; micrometer for thin threads.

Societe Generale d'Optique (Huet), Paris, Exhibiting: Hand refractometers; direct-vision spectroscopes; spectrographs; photoelectric densitometer; spectrum projector; optical straightedge; alignment telescope; level; telemagnifier; microfilm reader.

Microscopes Nachet, Paris 5. Exhibiting: New Products—Self illuminating stereoscopic microscope; theodolite stage for polarizing microscope; mirror lenses; phase contrast. **Regular Products**—Biological, polarizing, stereoscopic, and photometallographic microscopes.

Parra Mantois (Societe Anonyme des Establissements), Les Vesinet (S&O). Exhibiting: New Products—Raw optical glass in slabs; light-dense and double-dense barium; Barite flints & special types (rare earths); molded lenses and prisms; colored glass for filters, discs &

be sure to see the exhibit of

FRENCH MANUFACTURERS' REGULATING & CONTROL INSTRUMENTS

(Sponsored by The Chambre Syndicale des Fabricants d'Appareils de Regulation et de Controle Industriel-10, Avenue Hoche, Paris 8e, France)

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Convention Hall • Philadelphia, Pa. • September 13 to 24, 1954

Listed below are members of the Association of French Manufacturers of Industrial Regulating & Control Equipment who are presenting some of their major and unusual products:

Société ARCA
56, rue de l'Eglise, Paris 15°

- ARCA-BROIDA pneumo-electronic potentiometric controlling pyrometer
- ARCA valve with pneumatic drive by MORIN tubular membrane servo-motor
- ARCA-BROIDA pneumo-electronic potentiometric recording pyrometer

Société CONTROLE & REGULATION
48, rue Pernety, Paris 14°

- Micro-flowmeter for gas under pressure
- Densitometer for gases

Société SOPAC
8-16, rue du Parc, Levallois-Perret (Seine)

- Thermostat trigger for electric switch, with circuit-breaker
- Thermostat relay for transformer protection.

Société FRANCEL (Sté Regulateurs FRANCEL)
34, rue de la Victoire, Paris 9°

- Precision areometer
- Precision tensiometer

Société MECI
123, Boulevard de Crenelle, Paris 15°

- Volumetric flow recorder (I.R.S.I.D. patent) to control plain or oxygen-enriched air-blast converter operation
- Continuous centrifugal force totalizer

Société PYROMETRIE INDUSTRIELLE
84, Boulevard Saint-Michel, Paris 6°

- Recorder for temperature and other physical quantities

Etablissements JULES RICHARD
25, rue Melingue, Paris 19°

- Recording B.C.M. thermometer
- Recording hydrometer
- Monocurve recording psychrometer in operation
- Hydrometer spinner
- Petrol type dial pressure gauge
- Cabinet thermostat
- Suction psychrometer

Société CONTROLE DE CHAUFFE
146, rue des Blains, Bagneux (Seine)

- Oxygen proportionator

Société CONTROLE BAILEY
3, rue Castex, Paris 4°

- Boiler Meter (Chaudimetre)
- Pyrotron
- BAILEY-JERGUSON level indicator

Visitors will be cordially welcomed by the official French representatives of the Association.

Correspondent in the United States:
DAMIRON CORP., 70 Pine Street, New York, N. Y.

For further information please telephone COlumbus 5-5676

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610 Fifth Avenue (Room 414) New York 20, N. Y.

For further information on (ARCA) **228**; (Bailey) **229**; (Chauffe) **230**; (Controle & Regulation) **231**; (Francel) **232**; (MECI) **233**; (Pyrometrie) **234**; (Jules) **235**; or (SOPAC) **236** circle number on inquiry card.

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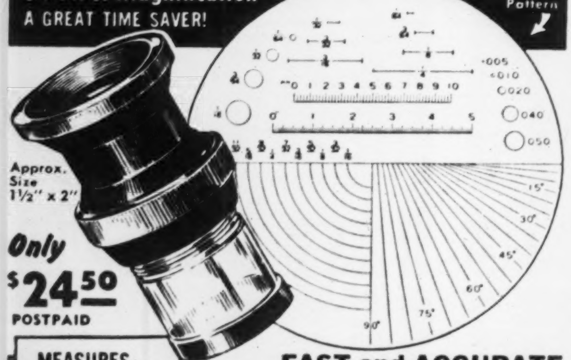

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Used in instruments requiring a monochromatic light source or a segment of the spectrum. All lamps fit a standard medium prefocus socket. Supply voltage: 220 A.C. Amperage: 1.0 to 1.5.

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50,055-AM	Cesium	29.20	50,061-AM	Neon	29.20
50,056-AM	Helium	29.20	50,062-AM	Rubidium	29.20
50,057-AM	Mercury	29.20	50,063-AM	Thallium	29.20
50,058-AM	Mercury Cadmium	32.30	50,064-AM	Zinc	29.20
50,059-AM	Potassium	29.20	50,065-AM	Mercury Sulphide	38.48

EDMUND SCIENTIFIC CORP., Barrington, N. J.

For more information circle **237** on inquiry card.

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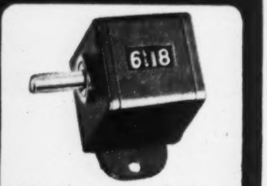
High speed, direct reading. Indicates increment of measurement in radar navigation instruments.



"Y" Rotary Counter used in navigating instruments.

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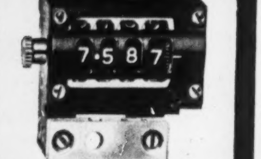
Special counter for Tape Recorder to indicate position of tape passing through recorder.



Special high speed Y-type for Goniometer application.

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114 S. Water St.
Providence 3, R. I.
BOOTH NO. 852

PRODUCTIMETERS
Count Everything
75th ANNIVERSARY

For more information circle **238** on inquiry card.

squares. **Regular Products**—optical blanks; disks for mirrors and telescopes; scientific optical glasses.

Maison Naudet, Dourde & Cie. Sucers., Paris 3e. Exhibiting: New Products—Automobile altimeters; recording thermometers and barometers; **Regular Products**—Cabinet room barometers and movements; hair hygrometers; altimetric and holosteric maritime barometers.

Paget Morel-Lux Optical, Paris. Exhibiting: New Products—Gold-plated optical frames. **Regular Products**—Gold-plated, monel and plastic optical frames; plastic and gold-plated sun glasses.

Societe Francaise des Regulators Universels Arca. Paris. Exhibiting: New Products—Electronic air-operated potentiometer pyrometer recorder and controller; Morin servomotor.

Circle **228** on inquiry card.

Sopac—Regulation, Levallois, Perret (Seine). Exhibiting: New Products—Transformer thermostat. **Regular Products**—Thermostats; pressure switches; control relays; thermometers and recorders with contacting devices.

Circle **236** on inquiry card.

Controle Bailey, Paris IV. Exhibiting: New Products—Boiler meter; Pyrotron. **Regular Products**—Indicators and recorders for pressure, differential, flow, level, temperature; relays; valves; control drives; feedwater regulators; desuperheaters; area meters.

Circle **229** on inquiry card.

Controle et Regulation, Paris. Exhibiting: New Products—Gravimetric microflowmeter for gases; gas densimeter. **Regular Products**—Instrumentation for flow, pressure, level, temperature, density, gas analyses; calorimeters.

Circle **231** on inquiry card.

Controle de Chauffe (Le), Bagneut (Seine). Exhibiting: New Products—Continuous oxygen analyzer. **Regular Products**—Infrared gas analyzer; combustion efficiency meter; flowmeters; draft controllers; combustion safeguards.

Circle **230** on inquiry card.

Societe "Regulateurs Francel," Paris, 9eme. Exhibiting: New Products—Area meter; tensiometer. **Regular Products**—Electro-pneumatic and electronic controllers; cycle controllers; valves; instrumentation for pressure reducing and overheating; remote command and positioning.

Circle **232** on inquiry card.

S.A. Meci, Paris. Exhibiting: New Products—Null-balance-type continuous flow integrator; air and oxygen recorder for a steel converter. **Regular Products**—Instruments for flow, density, level, pressure, temperature, conductivity, pH gas analysis, polorography, remote transmission; electric furnaces.

Circle **233** on inquiry card.

Pyrometrie Industrielie (La), Paris 60, Exhibiting: New Products—Recording and controlling potentiometers; indicating electronic potentiometer; immersion thermocouple assemblies. **Regular Products**—Galvanometer-type pyrometers, temperature controllers and recorders; portable standard instruments; cycle transmitter; thermal inertia compensator; thermocouples and assemblies; resistance elements.

Circle **234** on inquiry card.

Establissements "Jules Richard," Paris 19e. Exhibiting: New Products—Recording manometers; thermometers and hygrometers. **Regular Products**—Thermostats; dynamometers; chronographs; counters; voltmeters; ammeters; wattmeters; meteorological instruments; **Verascops.**

Circle **235** on inquiry card.

Fulton Sylphon Div., Robertshaw-Fulton Controls Co.,
Knoxville 1, Tenn. 726, 728, 730

Exhibiting: New Products—Cooling controls for diesel engines, etc.; Thermopilot for air motor valves; hot-cold water mixer; wall thermostats for electric heating systems; float-operated valves. **Regular Products**—Temperature and pressure controls; safety regulators, diesel; metal bellows and assemblies; packless valves.

See ad on page **1235**. Circle **72** on card.

Gaertner Scientific Corp., Chicago 14, Ill. 1011, 1013

Exhibiting: Spectrometers; toolmaker's microscope; optical bench assembly; ring spherometer; cathetometer; comparators; interferometers.

R. P. Gallien & Son, Los Angeles, Calif. 326

Exhibiting: New Products—Shock-absorbing jewel systems for aircraft, industrial, and automotive instruments. **Regular Products**—Instruments makers' lathes; cleaning machines and solutions; drill presses; magnifiers; hand tools.

At Booth 326 See our NEW
Micro Drilling Machine and
Automatic Instrument Cleaning Machine
R. P. Gallien & Son,
220 W. Fifth St., Los Angeles 13, Calif.

For more information circle **239** on inquiry card.

General Electric Co., Schenectady 5, N. Y. 531, 533, 535, 537

Exhibiting: New Products—Recording controller and indicator; dewpoint recorder; moisture monitor; mass spectrometer; insulation analyzers; winding insulation tester; insulation resistance meter; process timer; mercury vapor detectors; integrating instruments; hook-on instruments; leak detector; vibration relay and detector; portable and automatic integrator. **Regular Products**—Pyrometers; thermocouples and wire; high-potential tester; insulation resistance meter; photoelectric recorder; tachometers; oscillograph; strain gage amplifier; H-leak detector; molecular and thermocouple vacuum gages; ion gage; vibration indicators and recorders; ultrasonic generator; instrument lamps.

See ad on pages **1116-1117**. Circle **2** on inquiry card.

General Electric Co., X-ray Dept., Milwaukee 1, Wis. 357, 359, 361

Exhibiting: X-ray and electron diffraction analysis and gaging apparatus.

General Mills, Inc., Mechanical Div., Minneapolis, Minn. 1135, 1137

Exhibiting: New Products—Coordinate converter, a bombing system component illustrating precision motion transfer. **Regular Products**—Ryan flight recorder; mechanical arm; polyethylene high altitude balloons.

General Precision Equipment Corp., New York 38, N. Y.
601, 603, 605, 607, 609, 611, 613, 615, 617

Exhibiting: Refer to listings of subsidiaries—Askania Regulator Co., Bludworth Marine, General Precision Laboratory, Hertner Electric Co., Kearfott Co., Librascope, Inc., Link Aviation, Inc.

Booth No.

General Precision, Lab., Inc., Pleasantville, N. Y. 609, 611

Exhibiting: New Products Industrial TV systems, (a) complete camera and accessory package, (b) small camera controlled from separate control unit; Wickes color-TV equipment. **Regular Products** Remote control for industrial TV; Electronic instruments.

See ad on page **1213**. Circle **51** on inquiry card.

Genisco, Inc., Los Angeles 64, Calif. 744

Exhibiting: New Products Pressure pickup; accelerometers; G-accelerator. **Regular Products** Accelerometers, G-accelerators; rate-of-turn table; digitizer.

M. E. Gerry & Co., Inc., Upper Darby, Pa. 1607

Exhibiting: Products of Metrix, Inc.; Power Designs, Inc.; and E. V. Naydor Labs.

G. M. Giannini & Co., Inc., Pasadena 1, Calif. ... 401, 403, 1007

Exhibiting: New Products Booths 401, 403 Telemetering commutators; Magseal relays; pressure switches. Booth 1007 Digital instrumentation. **Regular Products** Accelerometers; gyros; pressure instruments; potentiometers; binary and decimal coded commutators; digitizers and digital instrumentation.

See ad on page **1216**. Circle **54** on inquiry card.

Goodyear Aircraft Corp., Akron, Ohio 1111, 1113

Exhibiting: G.E.D.A. line of analog computing equipment.

Gotham Instruments Div., American Machine & Metals, Inc.,
New York 7, N. Y. 756, 758, 760, 762

Exhibiting: Temperature and pressure recorder-controllers; thermometers.

Gow-Mac Instrument Co., Madison, N. J. 1036, 1038

Exhibiting: New Products T/C sensing elements; calibrated Gas Masters; air-gas ratio meters; rare gas purity recorder. **Regular Products** Thermal conductivity cells; Gas Masters.

See ad on page **1201**. Circle **304** on inquiry card.

Graydon Smith Products Corp., Boston 14, Mass. 551

Exhibiting: Metristite measuring head; custom-built test and measuring equipment.

The **METRISITE** is a transducer for conversion of mechanical position to electrical signal. Linearity over ±0.2" travel is better than 0.1%. Sensitivity: 0.0001" full scale with standard amplifier: Reaction force proportional to displacement is less than 0.000004 oz. at 0.1". Stability and long-term reproducibility are excellent. Applications: Determination of variables susceptible to measurement by displacement, such as weight, pressure, torque, and strain. **Graydon Smith Products Corporation, Manufacturer.** 150 Causeway Street, Boston 14, Massachusetts.

For more information circle **240** on inquiry card.

Gray Instrument Co., Philadelphia 44, Pa. 1048

Exhibiting: New Products 5-dial shielded resistance box; deflection potentiometer; portable engine thermometer tester. **Regular Products** Wheatstone and Kelvin bridges; resistance standards and boxes; potentiometers.

See ad on page **1188**. Circle **252** on inquiry card.

Grayhill, La Grange, Ill. 245

Exhibiting: Switches (push-button, snap-action, rotary-tap); test clips; diode holders; stand-off insulators; moldings.

See ad on page **1201**. Circle **303** on inquiry card.

Linde Trade-Mark **synthetic sapphire**

...for excellent optical transmission

PLUS physical strength and chemical inertness

Sapphire is hard, strong, chemically inert and transmits a high percentage of radiation in the important ultra-violet and infra-red regions. At 1750A forty per cent of the radiation is transmitted by a .059 inch section; at 5.7 microns forty per cent is transmitted by a .100 inch section. This unique combination of properties makes it ideal for optical systems that require resistance to abrasion and corrosion and high temperature strength as well as excellent optical transmission.

Now single-crystal sapphire windows are available in diameters up to 2 inches in several finishes. For further information, call or write your nearest LINDE office.

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For more information circle **241** on inquiry card.

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TEMPERATURE CONTROLLER

VERSATILE
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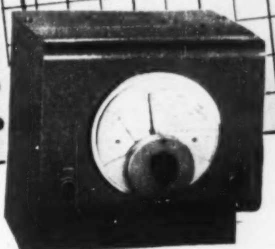
SAFE!



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A FEW TERRITORIES STILL OPEN FOR MFG'S AGENTS

For more information circle **242** on inquiry card.

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PRECISION POTENTIOMETER TRANSLATORS

ACCELERATION
- SUB MINIATURE SIZE
- RANGES ± 0. 5g To 100 gs
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- STROKES TO 12 INCHES
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- SUPER-SONIC
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ELLISON LABORATORY APPARATUS for ACCURACY

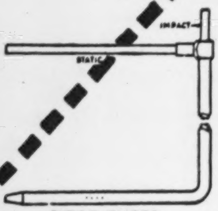
DRAFT GAGES

Inclined and vertical draft gages. Level and tube replaceable in field. Constant zero. Bulletin 109.

PORTABLE GAS ANALYZER

Accurate, easy-to-use Combustion Testing Set is equipped for analysis of CO_2, O_2 and CO, complete with flue gas thermometer. Described in Bulletin 120.

★ PORTABLE GAS ANALYZER



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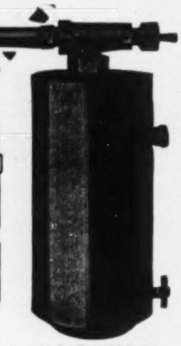
For air and gas flow measurements. Angle and Straight Stem Types. Conical and hemispherical tips; brass for temperatures to 500°F.; stainless steel for temperatures to 1000°F. Described Bulletin 109.



U-PATH STEAM CALORIMETER

Combines a throttling, separating and re-evaporating calorimeter in a single chamber. Soundly engineered and constructed. Ask for Bulletin 118.

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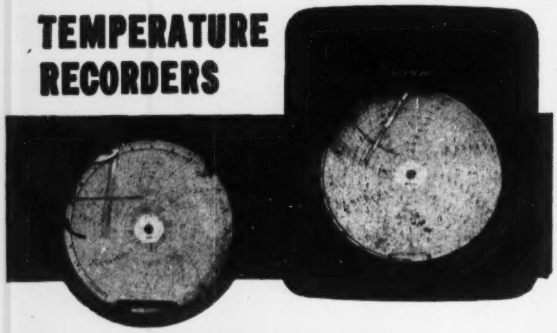
546 W. MONROE ST. Since 1896 CHICAGO 6, ILL.

THE ELLISON LINE ALSO INCLUDES:

Draft Gages, Bell and Diafram—Inclined Draft Gages—Portable Inclined Vertical Tube Gages—Vertical Tube Gages—Oil, Heavy Liquid and Mercury—Single and Multi-Tube-Saturator Gages—U Gages—Stationary and Portable—Air Filter Gages—Dial and Inclined Tube Types—Pitot Tubes—U Path Steam Calorimeters—Portable Gas Analyzers-Orsat Type

For more information circle **244** on inquiry card.

TEMPERATURE RECORDERS



to avoid lost profits

Accurate Foxboro Temperature Recorders give you a minute-by-minute report of process conditions — an invaluable aid in determining future operation. Moreover, the records forecast impending difficulties — permitting corrections to be made before costly trouble starts.

Available with vapor pressure, gas pressure, or liquid expansion type systems. Choice of 50 standard bulbs; 700 chart ranges and scales from —450° to +1000°F. Round or rectangular cases for all operating conditions. Exclusive Foxboro design and construction advantages detailed in Bulletin 447. (Temperature indicators and controllers also available.) Write **The Foxboro Company, 468 Neponset Ave., Foxboro, Mass.**

FOXBORO TEMPERATURE RECORDERS

For more information circle **245** on inquiry card.

Booth No.

Green Instrument Co., Cambridge 39, Mass. 419
Exhibiting: Pantograph engravers; cutter grinder; rotary tables; drum dial fixtures; production holding fixtures.
See ad on page **1188**. Circle **253** on inquiry card.

Greibach Instruments Corp., Metuchen, N. J. 1505
Exhibiting: New Products—Thermocouple a-c. meter; differential microammeters. **Regular Products**—Greibach ultrasensitive meter with pivotless suspension.

Gulton Mfg. Co., Metuchen, N. J. 1505
Exhibiting: New Products—Miniature blast and pressure gages; differential-transformer pickups; self-amplifying accelerometers; tri-directional piezoelectric accelerometers. **Regular Products**—Shock and vibration instruments; subminiature accelerometers, amplifiers, filters, low-noise cable and connectors; transducers; delay lines; capacitance bridges.

W. & L. E. Gurley, Troy, N. Y. 1019, 1021
Exhibiting: New Products—Collimators; sighting telescopes; wide-angle projection lenses; Digital computer optical elements; photoelectric transducers; resolution targets; precision scales; optical micrometers; reticles; optical tooling. **Regular Products**—Surveying, paper, textile, and research instruments; anemometers; water level, current meters and recorders.

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precision dividing . . .
reticle facilities . . .
complete optical shop . . .

since 1845

W. & L. E. Gurley, Troy, New York

For more information circle **246** on inquiry card.

Wm. J. Hacker & Co., Inc., New York 5, N. Y. 826
Exhibiting: New Products—Research metallograph; Micro-viewscope, for analysis of fibres and microscope slides; Research microscope. **Regular Products**—Microscopes; microtomes; metallographs; testing machines; heating and freezing stages; cameras for photomicrography.

Hagen Mfg. Co., Inc., Moline, Ill. 946
Exhibiting: Synchronous motors; reversing synchronous motors; motor-driven timers.

Hamilton Watch Co., Lancaster, Pa. 327, 329
Exhibiting: Timing instruments; small mechanisms; alloy strips; lubricants; diamond tools; instrument screws; taps & dies, gages; springs; special instruments.

Hammel-Dahl Co., Warwick, Providence 5, R. I. 410, 412
Exhibiting: New Products—Seal balance angle valve; Flash-flo plug; Ultravalve design; side-mounted handwheel; manually-operated control valve. **Regular Products**—Control valves.
See ad on Back Cover. Circle **197** on inquiry card.

Hankison Corp., Pittsburgh 16, Pa. 727, 729
Exhibiting: New Products—Pipe line filters, disposable-cartridge type. **Regular Products**—Instrument air filters and dryers; liquid feeders.
See ad on page **1191**. Circle **259** on inquiry card.

"M" series CONDENSIFILTERS are NEW

Visit Booths 727 and 729 to see the new Models M-30 & M-100 Condensifilters

HANKISON CORPORATION

Pittsburgh 16, Pa.

Complete Air Filtering Systems

For more information circle **247** on inquiry card.

Hastings Instrument Co., Hampton, Va. 319
Exhibiting: New Products—Vacuum indicator-controller; electronic flowmeter. **Regular Products**—Air-meters; electronic manometer-flowmeter; electronic standard cell; accelerometer; vacuum gage; wind velocity recorder.

Hathaway Instrument Co., Denver, Colo. 300, 302
Exhibiting: New Products—Portable strain indicator; 24-channel Aircraft oscillograph; high-speed camera.
See ad on page **1163**. Circle **38** on inquiry card.

Hays Corporation, Michigan City, Ind. 505, 507
Exhibiting: New Products—Feedwater control systems, electronic operation. **Regular Products**—electronic oxygen recorder-controller; carbon-dioxide controller; electronic flowmeter; miniature indicators; draft and low-pressure instruments; liquid flow controller; electric and pneumatic transmitters; gas analyzers.

A. W. Haydon Co., Waterbury 20, Conn. 816, 818
Exhibiting: New Products—Miniature hermetically-sealed: repeat cycle timers, time delay and adjustable t-d relays. **Regular Products**—Repeat cycle timers; time delay relays; elapsed time indicators; intervalometers; stop clocks; hermetically-sealed timers; timing motors.

H-B Instrument Co., Inc., Philadelphia 40, Pa. 924
Exhibiting: New Products—Quiksite thermometers. **Regular Products**—Thermometers; hydrometers; thermoregulators; thermostats; mercury-plunger relays.
See ad on page **1194**. Circle **268** on inquiry card.

Heat-Timer Corp., New York 12, N. Y. 1516
Exhibiting: Recorder-totalizer; electronic heat control; electronic smoke alarm.

Heiland Research Corp., Denver 9, Colo. 332, 334
Exhibiting: New Products—60-channel high-speed recording oscillograph. **Regular Products**—Portable recording, and 8, 12-in. oscillo-

Booth No.

graphs; amplifiers system; bridge balance unit; sub-miniature galvanometers.

Heise Bourdon Tube Co., Inc., Newton, Conn. 855
Exhibiting: New Products—Pressure gages with integral movement and external bleeder. **Regular Products**—Precision pressure gages.
See ad on page **1274**. Circle **123** on inquiry card.

Karl Heitz, Inc., New York 19, N. Y. 358
Exhibiting: New Products—Prism binoculars, super-stroboscope, prismatic binocular microscopes, and telescopes; color temperature meter; light meter; pocket microscope; optical testing, measuring, recording instrument. **Regular Products**—35-mm. cameras; binoculars, monoculars, lenses, optical flats, miniature light meter.

Helicoid Gage Div., American Chain & Cable Co., Inc., Bridgeport, Conn. 520
Exhibiting: New Products—Probe-type pressure indicating chemical gage for local or remote indication. **Regular Products**—Pressure, vacuum, and compound pressure gages.
See ad on page **1337**. Circle **175** on inquiry card.

Herbach & Rademan, Inc., Philadelphia 7, Pa. 260, 262
Exhibiting: New Products—3-turn single and ganged pot; instrument motors; electronic relay. **Regular Products**—Voltage regulators; industrial electronic instruments and supplies.

Hertner Electric Co., Cleveland 11, Ohio 613
Exhibiting: New Products—Motor generator; generator set; servomotor; synchromotor; a-c. motor and brake. **Regular Products**—Small a-c. motors.

Hetherington & Berner, Inc., Indianapolis 7, Ind. 356
Exhibiting: Automatic liquid batching system; jacketed automatic valves.

Hewson Company, Inc., Newark 2, N. J. 1031, 1033
Exhibiting: High-speed static control systems; high-voltage d-c. insulotion test sets; master static alarm systems.

Hills-McCanna Co., Chicago 18, Ill. 101
Exhibiting: New Products—Packless, positive-displacement pump. **Regular Products**—Saunders patent diaphragm valves; mechanical and hydraulic metering and proportioning pumps; lubricators.
See ad on page **1329**. Circle **165** on inquiry card.

You are invited
to a special demonstration
of the new HILLS-McCANNAMETER
"the meter that pumps"
Pick up your complimentary ticket
at the Hills-McCanna booth—No. 101

For more information circle **248** on inquiry card.

Hoke Inc., Englewood, N. J. 439, 441
Exhibiting: New Products—Positive-closing toggle valves; high-vacuum valves; miniature bellows and O-ring sealed valves. **Regular Products**—Valves; pressure regulators; flowmeters; stainless cylinders.
See ad on page **1261**. Circle **108** on inquiry card.

HOKE welcomes you to the
INSTRUMENT SHOW
and invites you to bring
your small valve problems to
BOOTHS 439 and 441

SPECIAL: Collection of accessory equipment for mass spectrometry.

NEW: Full line of bar stock toggle valves.

HOKE INCORPORATED
Fluid Control Specialists
Englewood, New Jersey

For more information circle **249** on inquiry card.

Holger Andreasen, Inc., San Francisco 3, Calif. 1159, 1161
Exhibiting: New Products—260 kVp portable x-ray unit for industrial radiography. **Regular Products**—175 kVp portable x-ray units.

Howard Industries, Inc., Racine, Wis. 1614
Exhibiting: Fractional horsepower motors.

Hughes Aircraft Co., Culver City, Calif. 1023, 1025
Exhibiting: New Products—Electronic business systems; Radomes; silicone junction diodes. **Regular Products**—Radar, fire-control and guided-missile systems; digital computers; antennas; indicator and microwave tubes; germanium diodes.
See ads on pages **1193**, **1340**. Circle **180** or **163** on card.

Hycon Mfg. Co., Pasadena 8, Calif. 226
Exhibiting: Topographic maps; aerial camera equipment.

Hygrotester, Inc., Brooklyn 1, N. Y. 139
Exhibiting: New Products—Automatic-traversing moisture-measuring instrument for paper and pulp machines. **Regular Products**—

ELECTRO SNAP
STANDARD
Snap-Action
BASIC SWITCH
MECHANICAL LIFE SPAN
OVER 10 000 000 OPERATIONS

Cut-Away View of Type S2

Here's the Precision Switch that Gives You Extra Features at No Extra Cost

- *LONG MECHANICAL LIFE*
  Carries life rating of 10,000,000 mechanical operations with precise repeatability of entire life of switch.
- *HIGH CAPACITY*
  UL rated at 10 amps, 125/250 v. ac or 30 v. dc. Wiping action of contacts reduces arcing for long electrical life.
- *SMALL SIZE*
  Durable plastic case measures only 1¼" long, ½" wide and ½" high, permitting more compact designs and mounting arrangements.

Send for details in Specification Sheet STG-8

see our catalog in
PRODUCT DESIGN FILE
or write for copy

ELECTRO-SNAP SWITCH AND MFG. CO.
4224 West Lake Street Chicago 24 Illinois

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ENGINEER • FOR DESIGN OF INSTRUMENTS AND ALLIED CONTROLS

Opportunity for an engineer to fill responsible position in the design of automotive instruments, industrial temperature gages, recorders and controllers. Should have about 10 years' experience and will have the responsibility of handling redesigning of present products and the designing of new units to be added to the line of automotive and aircraft instruments.

Junior ENGINEERS • FOR INDUSTRIAL AND AUTOMOTIVE INSTRUMENTS

We are looking for two young engineers who will be given responsibility and opportunities for advancement as fast as they can move up. Assignments will be with either industrial instruments or automotive instruments.

■ ■ ■

Investigate your opportunities with this fast growing leader in the industry. The addition of new products and the expanding of present lines provide many opportunities for rapid advancement.

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THE ELECTRIC AUTO-LITE COMPANY
TOLEDO 1, OHIO

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PORTABLE POTENTIOMETERS by GRAY

E-3043

E-3042 and E-3043

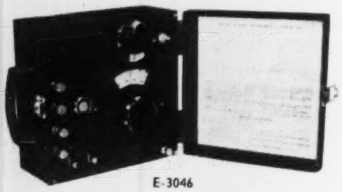
Double range in M.V. on step switch and 220 division slide wire scale. Accuracy ±0.05% or ½ scale division whichever is greater. Wood case.

E-3045-V & E-3045-DV

Single or double range in M.V. on slide wire scale. Manual cold junction compensator 0-1 and 0-5. Useable on either range. Accuracy ¼% of full scale. Wood case.

E-3048 V AND E-3048-DV

Single or double range in degrees F or C for any type thermocouple. Automatic cold junction compensation. Accuracy ¼% of full scale. Wood case.



E-3046

E-3046-V and E-3046-DV

Single or double range in M.V. manual cold junction compensator, 0-1 and 0-5. Useable on either range. Accuracy ¼% of full scale. Metal case. E-3046-T and E-3046-D.T.

Single or double range in degrees; F or C. For any thermocouple. Automatic cold junction compensation. Accuracy ¼%. Metal case.

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64 W. Johnson St., Philadelphia 44, Pa.

SEE YOU AT OUR BOOTH 1048 AT THE SHOW IN SEPT.

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Versatility
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ENGRAVES
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Mark your own symbols, numbers, lettering, on your small parts, tools, identification and name plates . . easily, simply, quickly . . tracing from a master with the GREEN ENGRAVER. Widely used in electronic and plastic fields, in machine tool shops and wherever permanent marking is needed. The GREEN ENGRAVER engraves equally well on metals, plastic, wood, hard rubber and glass.

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Etching attachment and other special equipment for industrial uses are available. Fact-filled folder on request showing how economies in costs, labor and time are achieved with the GREEN ENGRAVER.

For more information circle **253** on inquiry card.

Booth No.

Moisture measuring and regulating instruments for non-metallic products; for basis-weight and caliper in pulp and paper.

Illinois Testing Labs., Inc., Chicago 10, Ill. 612, 614
Exhibiting: New Products Electronic temperature controllers and excess temperature cut-outs. **Regular Products** Pyrometers; air velocity meters; dew-point instruments; resistance thermometers.
See ad on page **1194**. Circle **266** on inquiry card.

Imperial Brass Mfg. Co., Chicago 7, Ill. 432, 434
Exhibiting: New Products Fluid control valves; panel-mounted diaphragm valves; tube benders; plastic tube fittings; tube flaring and burnishing tool; capillary tube restrictor; brass flared fittings. **Regular Products** Metal and plastic tube fittings; flared tubes; brass pipe; valves; flexible hose and fittings; tube-working tools; test plugs.
See ad on page **1242**. Circle **79** on inquiry card.

Industrial Engineering Corp., Louisville 8, Ky. 416, 418
Exhibiting: New Products Pressure gage protector; graphic panels and functional test equipment; tachometer test stand; portable hydrostatic pressure test units; field-rebuildable panels. **Regular Products** Panels and test equipment.

Protect sensitive pressure instruments . . .

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INDUSTRIAL ENGINEERING
IEC
STYLE
RANGE
SERVICE

Shuts off gage or manometer connection at any pre-set pressure.

Models available with cutoffs from 1" water to 9000 psig. liquids & gases.

Designed to withstand and hold closed against 10,000 psig.

INDUSTRIAL ENGINEERING CORPORATION
525 E. Woodbine, Louisville, Ky.

For more information circle **254** on inquiry card.

Industrial Instrument Corp., Odessa, Tex. 448, 450
Exhibiting: New Products Recording flowmeter; flow indicator; unions; charcoal gas tubes. **Regular Products** Non-freezing instrument bearings; orifice plates, and well testers; critical flow provers; seal systems.
See ad on pages **1269**, **1197**. Circle **116**, **277** on inquiry card.

Industrial Laboratories Publishing Co., Chicago 6, Ill. 409

Industrial Pyrometer & Supply Co., Alton, Illinois 806, 808
Exhibiting: Insulated thermocouple lead wires; thermocouple connection heads; bare calibrated thermocouple wires; Porcelain, and metal protection tubes; thermocouple insulators.
See ad on page **1115**.

Industrol Corp., Roselle Park, N. J. 639
Exhibiting: New Products Finned-system dehumidifiers; dehumidifiers for gas sampling systems: **Regular Products**—Dehumidifiers; filters; dessicant adsorbers; process pilot plants.
See ad on page **1276**. Circle **126** on inquiry card.

Infra Electronic Corp., Roseland, N. J. 1808
Exhibiting: Phase-angle meter; turns-checking device; precision lamination notching press; servomotors; synchros.

Instrof, Inc., Philadelphia 43, Pa. 932, 934
Exhibiting: New Products Tube-mounting clip systems. **Regular Products** Trough system, fittings for tubing.
See ad on page **1291**. Circle **152** on inquiry card.

Instron Engineering Corp., Quincy, Mass. 438, 440
Exhibiting: New Products Table model tension or compression tester-recorder. **Regular Products** Universal testing machine; integrator; X-Y recorder chart drive.

Instrument Laboratory Service, Cleveland 11, Ohio 426
Exhibiting: New Products High-speed electronic pre-determined

"A new giant is making its appearance on the American industrial scene . . ., and it has announced its first trade exposition for November," says June INDUSTRIAL MARKETING.

You are invited to exhibit at The First

INTERNATIONAL AUTOMATION EXPOSITION

**which will be held at the
244th Regiment Armory New York City,
November 29th-December 2, 1954**

Purpose: To bring together, under one roof, the basic devices that make automatic production possible. Already scheduled for display are: Automatic control systems, automatic machine tools, automatic computers, automatic inspection devices, automatic work-positioning mechanisms, automatic motor controllers, automatic communication systems, and many components of such systems.

Write, wire or phone for complete information on this most significant show which deals with the rapidly developing field of automatic production.

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counter; pre-determined period gated counter; impulse generator; explosion-proof housings. **Regular Products** Electronic and electrical tachometers and timers; power supplies.

Instruments, Inc., Tulsa 6, Okla. 414
Exhibiting: New Products Telematic gage; Electr-O-Probe; Rad-O-Thik; product analyzer. **Regular Products** Gagetron; Denistron; Electr-O-Level; pneumatic transmitter; relays.

Instruments Publishing Co., Inc.
Pittsburgh 12, Pennsylvania 902, 904, 906, 908
Exhibiting: Publications "Instruments & Automation"; "Instrument & Apparatus News"; Instrument Manufacturing"; Buying directories—"The Instruments Index" and "The Instrument Manufacturing Guide". **Books** "The Handbook of Measurement and Control"; Process Control" by A. J. Young; "Nuclear Reactors for Industry and Universities" edited by Ernest H. Wakefield; "Electronic Circuitry for Instruments & Equipment" by M. H. Aronson; others.

International Equipment Co., Boston 35, Mass. 1003
Exhibiting: New Products Cabinet-style centrifuge; refrigerated centrifuge; sealed accessories for infections or radioactive materials. **Regular Products** Laboratory centrifuges and accessories.

International Testing Service, Saginaw, Mich. 305
Exhibiting: New Products Custom-built instruments, hydraulic control devices and servo systems. **Regular Products** Electronic control systems; custom-built test instruments.

International Resistance Co., Philadelphia 8, Pa. 1709
Exhibiting: Fixed and variable resistors; deposited-carbon, boron-carbon, and wire-wound precision resistors; chokes; rectifiers.

Richard Jahre, Berlin, Germany. (see Federal Telephone and Radio Company, Booths 202-204)

Japanese Exhibits:

Akashi Seisakucho-K. K., Higashi-Sinagawa, Sinagawa-Ku,
Tokyo 206, 206A
Exhibiting: New Products Micro hardness tester; Akashi hardness tester. Desk-type electron microscope.

Ueshima Seisakusho-Ltd., Shinjyuku-Ku, Tokyo 208
Exhibiting: Tensile tester with controlled-temperature test cabinet for plastic sheet, fabric, leather, etc.

Mitsutoyo Seisakusho K. K., Kawashaki 208A
Exhibiting: Indicating micrometer; passameter; micrometer.

Tsuda Denkikeiki Seisakusho-K. K., Osaka 208A
Exhibiting: D-c. watthour meter.

Osaka Meter, K. K., Neyagawa City, Osaka 208A
Exhibiting: Taximeter, speedometer.

Jarrell-Ash Co., Newtonville 60, Mass. 1110
Exhibiting: New Products Microspectrophotometer with double-beam optical system; microphotometer; hydrogen discharge source. **Regular Products** Gamma correcting fan scale calculator; photoprocessor.

See ad on page **1281**. Circle **134** on inquiry card.

Instrument Manufacturers

These special issues of INSTRUMENTS and AUTOMATION offer you extra reader coverage and interest:

- **OCTOBER ISSUE begins new serial—"The Automatic Factory, a Critical Examination"—the top topic of today.**
- **NOVEMBER ISSUE—post-ISA-show issue contains special show-report, including highlights, features, and exhibits; this issue is always of extreme interest to the thousands of instrument men who could not attend the show.**
  ALSO—November will be the pre-Automation-SHOW issue listing exhibits and features of this important event.
- **DECEMBER ISSUE—Part 2 of this issue will be the separately-bound and revised 2nd edition of the HANDBOOK OF MEASUREMENT AND CONTROL. All subscribers will receive this.**
- **JANUARY (1955) ISSUE—will feature a complete report on THE FIRST INTERNATIONAL AUTOMATION EXPOSITION.**

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Scale Length—12 inches

Internal Potentiometer System

RANGES

CURRENT—.001 to 30 amperes full scale.
VOLTS—.1 to 3,000 volts full scale.

There is no machine that can duplicate the art of a Craftsman. Our scales are individually ***HAND DRAWN***, and the instrument is individually ***HAND CALIBRATED.***

Represented in Eastern Pennsylvania and Southern New Jersey by: I. E. Robinson Company, Upper Darby, Pa.

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MOUNT VERNON, N.Y.

ELECTRICAL INSTRUMENTS OF PRECISION SINCE 1927

For more information circle **314** on inquiry card.

Booth No.

J-B-T Instruments, Inc., New Haven 8, Conn. 304
Exhibiting: New Products—Toggle switches; **Regular Products**—Vibrating-reed frequency meters; elapsed-time meters; selector switches; temperature and electrical measuring instruments.

Jerguson Gage & Valve Co., Somerville 45, Mass. 947, 949
Exhibiting: New Products—Flow glasses; steam jacketed valves; self-draining valve; pipe nipple reamers; gage glass cleaners. **Regular Products**—Level gages, heated gages, large chambered gages; welding pad.
See ad on page **1222**. Circle **60** on inquiry card.

Jordan Regulator Corp., Cincinnati 2, Ohio 558, 657
Exhibiting: New Products—Pressure regulator and remote control valves; differential regulating valve; gas and air pressure regulator; sampling valve. **Regular Products**—Automatic control valves.

DON'T FAIL TO SEE THE NEWEST DEVELOPMENTS IN PROCESS CONTROLS.

Visit The Jordan "Straight-Thru" Booth No. 558-657.

For more information circle **256** on inquiry card.

Booth No.

Karn Chemical Equipment Co., Pittsburgh 2, Pa. 512
Exhibiting: Thermometer and thermocouple wells.
See ad on page **1272**. Circle **120** on inquiry card.

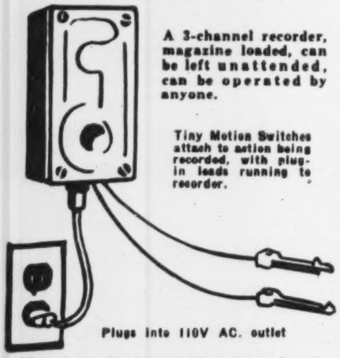
W. A. Kates Co., Deerfield, Ill. 259, 261
Exhibiting: New Products—Liquid flow regulators; Kates-Illium pump. **Regular Products**—Flow-rate regulators.

Kay Electric Co., Pine Brook, N. J. 1605
Exhibiting: New Products—Photoelectric edge registration control for textiles, etc.; explosion-proof remote TV monitor; HF counter-converter. **Regular Products**—Sound and vibration frequency analyzer; analyzer-spectrograph; sweep oscillators.

Kaye Development Co., Stamford, Conn. 254
Exhibiting: New Products—Trichrometer, continuous observation and/or automatic control of any color process. **Regular Products**—Quality control and process control instruments.

Kearfott Company, Inc., Little Falls, N. J. 615, 617
Exhibiting: New Products—Electro jet electro-hydraulic servo position device; servo digitizer; remote scale servo system; pressure and

The Alden Fact Finder, a new tool for monitoring or making studies on the spot.



A 3-channel recorder, magazine loaded, can be left unattended, can be operated by anyone.

Tiny Motion Switches attach to action being recorded, with plug-in leads running to recorder.

Plugs into 110V AC. outlet

Here is a simple recorder—just plug it into 110V—connect it easily with simple switches—get any kind of information. It consists of a case, 2x4x5 which houses the motor for driving the paper moving mechanism, and rectifier to supply the marking power.

It can be hung on the wall, laid on a bench, or hidden in a closet.

Pairs of leads of different lengths with contacts molded on them make it easy to connect the recorder to simple motion switches even at a distance.

Drive units can be supplied for different speeds.

1. A record which runs for 8 days shows you happenings up to 2 per minute.
2. A record which runs for 3 hours shows you happenings up to 2 per second.
3. A record which runs for ¾ hour shows you happenings up to 8 per second.

The operator simply notes when the record is started. The tape marks the time intervals automatically and two other happenings whenever they occur and for their duration.

In this simple recorder magazine you have a roll of paper which you simply feed past three contact rolls which are always in contact with the paper. Whenever you pass current through the contacts and the paper, the paper is indelibly marked. One contact roll supplies time marking at specific intervals; the other two rolls are available as marking channels to record whenever and whatever you want them to.

GET STARTED TODAY

Magazine Recorder ....$15.00 each
8 Day Drive Unit ....$35.00 each
3 Hour Drive Unit ....$50.00 each
¾ Hour Drive Unit ....$60.00 each

Write for "On-the-spot Fact Finder Booklet"

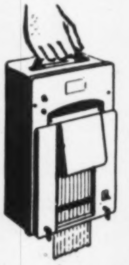
ALDEN ELECTRONICS AND IMPULSE RECORDING CO.
Westboro, Mass.

For more information circle **257** on inquiry card.

Here's a multi-channel recorder

- **ideal for automation monitoring**
- **for preautomation studies**

Gives 30 channels of information on 5" wide paper. You can take it to the spot where you want to use it.



Use it in your lab.

Rack mount it.

It is designed especially to be easy to connect and to be able to operate unattached. Has two fixed speeds—a slow and fast—and paper feed shaft is brought out so you can drive at any speed desired. Because Alfax doesn't smudge—don't have to pamper recording. Recorder is simple and rugged and can be used by unskilled help.

Can be left unattended, and shock and abuse won't interfere with operation or accuracy.

Optimally can have lights that tell of a change as well as the record to tell you what happened and when.

The 30 channel monitoring recorder uses .010 diameter wire with three grams pressure against the paper to do the marking, with a solid bar electrode on the opposite side. The contacts are always resting on the paper and whenever the current passes, the paper is indelibly marked. A slight amount of metal is removed from the contact surface during marking, thus providing a fresh recording surface. The wire is spring loaded so that it continually advances itself and will last indefinitely. In addition to the electrodes you simply have a paper supply and a paper feed which is usually driven by a synchronous motor to provide your time base. All elements are plug in unit construction—easily takes abuse, rough handling.

30-Channel "Fact-Finder" (1 and 6 inches of tape per minute)
Type 230A-6 ....$380.00
30-Channel "Fact-Finder" (1 and 12 inches of tape per minute)
Type 230A-12 ....$410.00
Standard Power Supply
Type 730-1A ....$ 85.00
Power Supply with channel-indicating lights
Type 740-1A $200.00

Send for "Multi-Channel Recorder Booklet"

ALDEN ELECTRONICS AND IMPULSE RECORDING CO.
Westboro, Mass.

For more information circle **315** on inquiry card.

Announcing—the first and much-needed book on small research reactors

Nuclear Reactors for Industry and Universities

written by eight eminent authorities and edited by Ernest H. Wakefield

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Chapter I.	Nuclear Reactor Types
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Chapter III.	Radioactivity Measurement
Chapter IV.	Radiation Protection
Chapter V.	Reactor Control
Chapter VI.	Instruments for Experiments
Chapter VII.	Cost Study
Chapter VIII.	Legal Aspects

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$2.00 postpaid

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temperature transmitters. **Regular Products**—Servomotors; synchros; gyros; amplifiers; airborne and industrial control systems.

KEARFOTT
Little Falls, New Jersey
Sales & Engineering Offices
1378 Main Avenue, Clifton, N. J.

Servo Systems including—Electro-Hydraulic and Electro-Mechanical **Servo System Components including**—Servo Motors, Synchros, Servo Motor-Tachometer Generators. **Gyros including**—Vertical, Free, Rate, Floated Rate Integrating. **Sub-Miniature** Electronic and Magnetic Servo Amplifiers. **Transducers** (high power output) for pressure, temperature and flow. **Precision Machinable Ceramics**—temperature resistant and chemically inert.

For more information circle **258** on inquiry card.

Kellogg Switchboard and Supply Co., Chicago 3, Ill. 1617
Exhibiting: New Products—Crossbar switch for electrical interconnections; magnetic impulse counter; allied equipment.
See ad on page **1287**. Circle **144** on inquiry card.

C. M. Kemp Mfg. Co., Baltimore 2, Md. 815, 817
Exhibiting: New Products—Desiccant dryers. **Regular Products**—Specialized dehydration equipment.

Kepco Laboratories, Flushing 55, N. Y. 1101, 1103
Exhibiting: New Products—Transistor power supplies. **Regular Products**—Regulated power supplies.

Kieley & Mueller, Inc., Middletown, N. Y. 526, 528, 530
Exhibiting: New Products—Split-body diaphragm control valve; displacement liquid-level controller; pressure pilot; valve body assemblies. **Regular Products**—Diaphragm control valves.
See ad on page **1225**. Circle **63** on inquiry card.

Kollmorgan Optical Corp., Northampton 1, Mass. 1008
Exhibiting: New Products—Industrial periscopes; remote-viewing instrumentation; borescopes; mirror systems. **Regular Products**—Projection lenses; prismscope; telescopic spectacles; rifle scopes.

Booth No.

Kybernetes Corp., Newark 5, N. J. 243
Exhibiting: New Products—High-speed electronic scanning and monitoring system; dynamic visual presentation of process variables on single cathode-ray tube; closed-loop TV systems.
See ad on page **1123**. Circle **8** on inquiry card.

Lambda Electronics Corp., Corona 68, N. Y. 1127, 1129
Exhibiting: New Products—Portable regulated power supply. **Regular Products**—Regulated and unregulated power supplies.

Landis & Gyr, Ltd., New York 36, N. Y. 850
Exhibiting: New Products—Electric impulse reset counters; positive and negative motion counters; predetermined counters; miniature roller bearings. **Regular Products**—Miniature roller bearings; ball bearings with capillary oil film seal.

Dr. B. Lange, Berlin-Zehlendorf, Germany 244
Exhibiting: New Products—Flame photometer; recording instruments. CdS and PbS crystal cells; U.R. photoelements; skin thermometers; spectrophotometers; **Regular Products**—Colorimeters; gloss meter; multiflex galvanometers; pH acidometers; turbidimeters; luxmeters; leukometers.

Lapp Insulator Co., Inc., Le Roy, N. Y. 402, 404
Exhibiting: New Products—Midget controller volume pumps. **Regular Products**—Auto-pneumatic volume pumps.

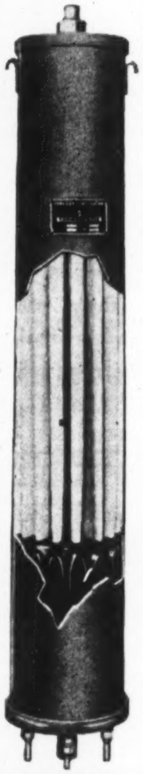
Leeds & Northrup Co., Philadelphia 44, Pa.
.... 1226, 1228, 1230, 1232, 1234, 1236
Exhibiting: Strip-chart recorder with digital read-out on adding machine; polar recorder drawing curves about an eccentric axis; strip-chart recorder with high-speed Rayotube; pneumatic-controller function-analyzing recorder; industrial indicators, recorders and controllers.
See ad on page **1170**. Circle **45** on inquiry card.

Lehigh Chemical Products Co., Chestertown, Md. 1718
Exhibiting: New Products—Synthetic damping fluids and greases for instrumentation. **Regular Products**—Synthetic oils, greases, and rust preventives.

Lenox Instrument Co., Philadelphia 3, Pa. 250
Exhibiting: New Products—Mine scopes for bore holes; heat exchanger scopes. **Regular Products**—Borescopes; periscopes; gas main scopes; tankscopes.

Leslie Co., Lyndhurst, N. J. 532, 534
Exhibiting: Pressure, temperature and level controls and regulators; diaphragm control valves; control pilots; controllers, strainers.
See ad on page **1335**. Circle **172** on inquiry card.

Librascope, Inc., Glendale 1, Calif. 607
Exhibiting: New Products—Radiation survey meter for civil defense; X-Y plotter; magnetic amplifiers. **Regular Products**—Analog and digital computers; computer components; input-output devices; automatic control systems.
See ad on page **1289**. Circle **149** on inquiry card.



Model A-100-D

Clean Up Your Instrument Air

ELIMINATE CONTROL FAILURES AND INSTRUMENT MAINTENANCE CAUSED BY WATER, DIRT AND OIL

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CONDENSIFILTERS

Many steel, power, paper, and other industrial process plants are specifying installations of CONDENSIFILTERS to eliminate instrument and control maintenance. By removing water and oil in both entrained and vapor states, together with dirt and pipe scale from your instrument air, CONDENSIFILTERS provide trouble-free operation. Consult our engineers on your specific compressed air problem.

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Model B-30-D

Booth No.

Light Laboratories, Brighton, Sussex, England (see Federal Telephone and Radio Company, Booths 202-204)

Linde Air Products Co., New York 17, N. Y. 1618
Exhibiting: New Products—Synthetic sapphire windows for infrared transmission; synthetic sapphire light pipe. **Regular Products**—Synthetic sapphire products; alumina polishing powders.
See ad on page **1185**. Circle **241** on inquiry card.

Link Aviation, Inc., Binghamton, N. Y. 228, 230
Exhibiting: Servo and computer components; high-precision gear box; potentiometer; ratio voltmeter; phase comparator; automatic cable checker.

LINK AVIATION, INC. - - - BINGHAMTON, N. Y.
Manufacturer of
- WORLD FAMOUS LINK TRAINERS AND SIMULATORS
- ELECTRONIC TEST EQUIPMENT
- COMPONENTS
- SIMULATED AIRCRAFT INSTRUMENTS
- ANALOG COMPUTERS
- AND OTHER SPECIAL ELECTRONIC DEVICES

For more information circle **260** on inquiry card.

Liquidometer Corp., Long Island City 1, N. Y. 714, 716
Exhibiting: New Products—Automatic dial-type remote indicator. **Regular Products**—Remote- and direct-reading tank gages.

Liston-Becker Instrument Co., Inc., Springdale, Conn. 1123
Exhibiting: New Products—Analyzer for two components in a complex gas stream. **Regular Products**—Plant stream infrared gas analyzer, also laboratory model; d-c. breaker amplifier.

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For more information circle **261** on inquiry card.

Arthur D. Little, Inc., Cambridge 42, Mass. 1105, 1107
Exhibiting: New Products—Collins helium cryostat for extreme low temperature research.

J. E. Lonergan Co., Philadelphia 6, Pa. 644, 646
Exhibiting: New Products—Advanced safety valve. **Regular Products**—Safety-relief valves; pressure, vacuum compound, altitude and combination gages; lubricating devices; air and steam whistles.

Lord Mfg. Co., Erie 6, Pa. 838
Exhibiting: New Products—Shipping container and all-weather mountings for electronic, aircraft, and industrial equipment; silicone vibration-control mountings. **Regular Products**—Bonded-rubber vibration isolation mountings; idler wheels, flexible couplings, meter mounts.

Magnaflux Corp., Chicago 3, Ill. 301, 303
Exhibiting: New Products—Sheet-steel-thickness measuring instrument; conductivity meter. **Regular Products**—Magnetic particle, and flourescent penetrant inspection; brittle coating for stress analysis.

Booth No.

Magnetics, Inc., Butler, Pa. 315, 317
Exhibiting: New Products—Magnetic laminations; magnetic shields for cathode-ray and other tubes; powdered Molybdenum cores. **Regular Products**—Tape-wound cores; magnetic amplifiers, and reactors.

Magnetrol, Inc., Chicago 23, Ill. 509, 511
Exhibiting: New Products—Displacement-type high-pressure units in flanged steel chambers; steel-bodied flow alarm switches. **Regular Products**—Liquid level controls.

Manning, Maxwell & Moore, Inc., Stratford, Conn. 856, 858, 860, 862
Exhibiting: New Products—Force-balance-type transmitters; safety-relief valves; stainless and steel valves; electronic process-control instruments. **Regular Products**—Gages and pneumatic transmitters for pressure, temperature, and liquid level; valves; thermometers and temperature regulators.
See ad on pages **1173**, **1247**, **1323**. Circle **202**, **86**, **157** on inquiry card.

Marine & Industrial Products Co., Philadelphia 37, ... 847, 849
Exhibiting: New Products—Diaphragm and miniature relief valves; combination relief and drain valve. **Regular Products**—Safety and relief valves.

Mason-Neilan Regulator Co., Boston 24, Mass. 643, 645, 647, 649
Exhibiting: New Products—Differential pressure transmitter; pressure pilot; control valves; high-pressure liquid level controller; pressure regulator. **Regular Products**—Liquid level controllers; valves; regulators; industrial instruments.

Matisa Equipment Corp., Chicago 4, Ill. 249
Exhibiting: New Products—Flight data recorder; electric gyro horizon; jet-engine revolution indicator; accelerograph; speed recorder for locomotives; speed recorder for trucks, busses, etc.; single-chart central recorder for production of 36 machines; low-speed tachometer. **Regular Products**—Accelerometers; altimeters; barographs; spherical compass; turn and bank indicator.

M. B. Mfg. Co., Inc., New Haven 11, Conn. 827, 829
Exhibiting: New Products—Vibration exciter to test subminiature vacuum tubes; velocity pickup; vibration meter. **Regular Products**—Vibration exciters, pickups, meters, isolators; Isomode pad; AM mounts.

McGlynn Hays Industries, Belleville, N. J. 1711, 1713, 1715
Exhibiting: Measuring and checking instruments; machine tools with optical measuring systems.
See ad on page **1245**. Circle **83** on inquiry card.

McGraw-Hill Publishing Co., New York 36, N. Y. 258

Measurements Corp., Boonton, N. J. 459, 461
Exhibiting: New Products—Megacycle meters; standard signal generator for UHF. **Regular Products**—Noise and field strength meters; voltmeters; signal, square-wave and pulse generators; crystal calibrators; RF attenuators; special test instruments.
See ad on page **1253**. Circle **95** on inquiry card.

Mercoid Corporation, Chicago 41, Ill. 1242, 1244
Exhibiting: New Products—Mercury-switch-equipped differential pressure controls. **Regular Products**—Mercury-switch-equipped controls; sealed mercury switches.

Meriam Instrument Co., Cleveland 2, Ohio 751, 753, 755
Exhibiting: New Products—Vernier type arrangement for reading liquid column to 0.01 inch.; manometer magnifiers. **Regular Products**—Manometers; absolute pressure gages.
See ad on page **1271**. Circle **119** on inquiry card.

See New Meriam Manometer Modifications

Meriam Instrument Co. will display new reading aids for and modifications of manometers in its booths No. 751-753-755 at the show. These, plus many standard models which will also be exhibited, can help you solve problems of accurately indicating flow or pressure.

For more information circle **262** on inquiry card.

Merkelbach Products, New York, L. I., N. Y. 313
Exhibiting: New Products—Physics cabinets for lecturing on several levels of physics. **Regular Products**—Human anatomical models; skeletons and parts; zoological models; botanical models and mounts; Instruments and supplies for physics, chemistry and biological sciences; educational equipment.

Mertawatt A. G., Nurnberg, Germany 244
Exhibiting: New Products—High-voltage insulation testers combined with volt- or ohmmeter; ground testers; universal test meter. **Regular Products**—Electrical measuring instruments; single and multiple chart recorders; remote transmitters; photoelectric exposure meters.

Mesure & Controle (Foreign Trade department of following French companies) Paris 10, France 1044, 1046

AOIP (Association des Ouvriers en Instruments de Precisition)
Exhibiting: Automatic and strain-gage bridge; strain-gage and electronic precision balance; polarograph; electric charge detector; electronic amplifier.

Brion, Leroux & Co.
Exhibiting: Screened galvanometer; translucent units; voltage stabilizers; defiling scale units; d-c. micro-motors; relays.

Booth No.

Ferisol. (E. Geffroy & Co.)
Exhibiting: VHF signal generators; Q meter; electronic voltmeter, and millivoltmeter.

Ribet-Desjardins
Exhibiting: Magnetic comparator; 3-curve electronic commutator; cathode-ray oscilloscopes.

S.E.M.A.C. (Societe d'Etude de Materiel Automatique et de Controle)
Exhibiting: Pt wire thermometers-thermocouples; optical pyrometers; gas analyzers; pen recorders; pressure regulators; flowmeters; pH meters; fire detectors.

Metrotype Corporation, Summit, Ill. 545
Exhibiting: New Products—Positive-displacement type indicating, recording and integrating flow-rate meter. **Regular Products**—Digital recorder.

Micro Switch Div., Minneapolis-Honeywell Regulator Co., Freeport, Ill. 522, 524
Exhibiting: New Products—Illuminated push-button switches; sealed toggle, and subminiature switches; multi-pole subminiature toggle and push-button switches; rotary selector switches. **Regular Products**—AN and JAN approved switches; door interlocks; snap-action and mercury switches.
See ad on page **1248**. Circle **87** on inquiry card.

Microtime Laboratories, Culver City, Calif. 918
Exhibiting: New Products—Flash x-ray tube; high-voltage power supply. **Regular Products**—X-ray pulse generators; high-voltage pulse transformers; Kerr shutters.

Midwestern Geophysical Lab., Tulsa, Okla. 926
Exhibiting: New Products—Data repeater system with photography of remote receiver. **Regular Products**—Oscillographs, galvanometers; amplifiers; magnetic structures; hydraulic servovalves and watertight connectors.

William Miller Instruments, Inc., Pasadena 8, Calif. 117
Exhibiting: New Products—Airborne recording systems. **Regular Products**—Recording oscillographs, amplifiers, galvanometers, and transducers.
See ad on page **1221**. Circle **59** on inquiry card.

Milton Roy Co., Philadelphia 18, Pa. 131, 133, 135, 136
Exhibiting: New Products—Motor-driven flow control pump; ditto for submerged operation—air-operated for submerged operation; clutch actuated flow control pump; water hardness tester-recorder. **Regular Products**—Motor-driven flow control pumps.
See ad on page **1223**. Circle **61** on inquiry card.

Mine Safety Appliances Co., Pittsburgh 8, Pa. 431, 433
Exhibiting: New Products—Gascope, detects & locates leaks in gas distribution system; combustible gas analyzers. **Regular Products**—Infrared gas and liquid analyzers; aromatic hydrocarbon detector; hydrogen sulphide detector; carbon monoxide tester; Explosimeter; oxygen indicator.
See ad on page **1124**. Circle **9** on inquiry card.

Minneapolis-Honeywell Regulator Co., Philadelphia, Pa. 632, 634, 636, 638, 640, 731, 733, 735, 737, 739
Exhibiting: Electronic control systems; pneumatic, and mechanical instrumentation; miniature recorder-controllers; flowmeter with electronic integrator; instruments for research and pilot-plant instruments; pyrometer supplies, thermocouples, charts, extension wire, etc. Representative products of **M-H** divisions—Industrial, Heating controls, Commercial, Aeronautical, Microswitch, Valve, and Marine.
See ads on pages **1122**, **1230-1231**. Circle **7**, **68** on inquiry card.

John R. Monsell Company, Pitman, N. J. 506
Exhibiting: New Products—Centrifugal shaft seals; releaseable extensometers for testing metals. **Regular Products**—Pneumatic and platform scales.
See ad on page **1270**. Circle **118** on inquiry card.

Moore Products Co., Philadelphia 24, Pa. 1158, 1160, 1162
Exhibiting: New Products—Ratio flow control system. **Regular Products**—Valve positioners; nullmatic thermometers; M/P control stations and plug-in connectors; transmitters for flow, pressure, and liquid level.

F. L. Moseley Co., Pasadena 3, Calif. 253
Exhibiting: New Products—Flat bed portable X-Y recorder. **Regular Products**—X-Y recorder; curve follower; point plotter; voltmeter.

Murphy & Miller, Inc., Chicago 5, Ill. 237
Exhibiting: New Products—Humidity cabinet. **Regular Products**—Low temperature cabinet; humidity simulation cabinet.
See ad on page **1286**. Circle **142** on inquiry card.

Nash Engineering Co., South Norwalk, Conn. 109, 111, 113
Exhibiting: New Products—Instrument air compressors for automatic spot instrument air service. **Regular Products**—Clean instrument air compressors.
See ad on page **1160**.

National Electric Instrument Co., Elmhurst, L.I., N. Y. 353
Exhibiting: Borescopes.

National Instrument Labs., Inc., Riverdale, Md. 352
Exhibiting: New Products—Manometer, accuracy 0.0015 water differential at 150 psig; proportional gas flow controller; portable interferometer. **Regular Products**—Linear pressure drop flowmeter; oxygen regulator test stand.

Neptune Meter Co., New York 20, N. Y. 1814, 1816
Exhibiting: Remote control liquid metering systems.

New Hampshire Ball Bearings, Inc., Peterborough, N. H. 956
Exhibiting: New Products—Shielded radial, and flanged-shielded radial bearings. **Regular Products**—Micro precision instrument ball bearings.

New Hermes Engraving Machine Corp., New York 3, N. Y. 539
Exhibiting: New Products—Engraving machines for 15 sizes from one template. **Regular Products**—Engraving machines.

Norcross Corp., Newton 58, Mass. 421
Exhibiting: New Products—High-sensitivity viscosimeter; recording

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Conference

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September 13-24, 1954

You are invited to visit the

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Relocation of applicant must not disrupt an urgent military project.

For more information circle **263** on inquiry card.

Booth No.

viscosimeter for pneumatic control; temperature-compensated viscosimeter. **Regular Products**—Viscosimeters for process control.

Featuring—

- High sensitivity Viscometer with 1/4% accuracy (Demonstration).
- Recording Viscometer for Pneumatic Control.
- Temperature Compensated Viscometer.

Demonstrations at Booth 421 ▶ Write for Bulletin V-1000E ◀

NORCROSS CORPORATION, NEWTON 58, MASS.

For more information circle **264** on inquiry card.

North American Aviation, Inc., Downey, Calif. 1112
Exhibiting: Airborne instruments; communication equipment; atomic energy reactors.

North American Phillips Co., Inc., Mt. Vernon, N. Y. 1122, 1124, 1126
Exhibiting: New Products—Electron microscope, new model console 100 kv. **Regular Products**—Electron microscope; spectrograph; diffractometers.

North Shore Nameplate Inc., Bayside (L. I.) 61, N. Y. 1411
Exhibiting: Aluminum-foil anodized-etched pressure-sensitive nameplates; printed identification code markers for pipe, cable, wire, conduit; industrial safety signs.

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(SMALL ANGLE RADIATION DETECTION AND PRESENTATION)

★ AUTOMATICALLY CONTROLS LIQUID LEVEL

★ PRECISION MEASUREMENT OF MATERIAL THICKNESS AND DENSITY

NUCLEAR RESEARCH CORP.
Southampton, Pa.

For more information circle **265** on inquiry card.

Nuclear Research Corp., Philadelphia 46, Pa. 1009
Exhibiting: Gamma gage equipment for non-destructive tests; automatic liquid level and volume controllers.

Booth No.

Offner Electronics, Inc., Chicago 25, Ill. 702
Exhibiting: Dynograph recording assembly, direct-writing oscillograph, one amplifier covers all applications.

Ohmart Corp., Cincinnati 22, Ohio 246, 248
Exhibiting: Density gages for liquids, slurries and granular materials through use of radioactivity and Ohmart cells.

the ohmart corp.

PIONEERS IN THE APPLICATION OF RADIOACTIVE ENERGY IN INDUSTRY

For more information circle **267** on inquiry card.

Optical Film Engineering Co., Philadelphia 33, Pa. 1114
Exhibiting: New Products—Dichroic filters; electrical shielding films; front surface mirrors; films for reducing reflection. **Regular Products**—High-vacuum evaporators; metallizers; vacuum furnaces; TV tube and plate aluminizers; altitude chambers; high-vacuum accessories.

Palmer Thermometers, Inc., Cincinnati, Norwood 12, Ohio 747, 749
Exhibiting: New Products—3.5-in. stainless dial-indicating thermometer. **Regular Products**—Industrial, engraved laboratory, recording, and dial thermometers.
See ad on page **1236**. Circle **73** on inquiry card.

Panellit, Inc., Panalarm Div., Panascan Div., Skokie, Ill.
.... 831, 833, 835, 837, 839
Exhibiting: New Products—Panelgraph; lock-out and safety alarm systems; Panalog. **Regular Products**—Graphic panels; central control rooms; information, alarm and annunciator systems; scanning, monitoring, data-processing and data-reduction systems.
See ad on pages **1273**, **1143**. Circle **122**, **22** on inquiry card.

Parker Appliance Co., Cleveland 12, Ohio 927, 929
Exhibiting: New Products—Brass flareless tube fittings socket-type welded fittings. **Regular Products**—Flare and flareless tube fittings; tube fabricating tools; synthetic rubber O-rings; hydraulic system components.

Paul Valve Corp., New York 17, New York 1712
Exhibiting: Venturi ball specialty valves; air and hydraulic control valves; pressure and flow regulating valves; hand-operated throttling and stop valves.

Penberthy Injector Co., Div. of Buffalo Eclipse Corp., Detroit 2, Mich. 521
Exhibiting: Reflex and transparent gages; ejectors; floating shank gage valves; electric sump pumps.

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PRECISION DEW POINT INDICATOR

★ The Alnor is the only dew point indicator that is a complete unit in itself . . . it is readily portable and does not require external coolants or auxiliary apparatus.

★ Controlled testing conditions are assured. Indications take place in an enclosed chamber . . . dew or fog is observed suspended in air—not on a polished surface. This means greater accuracy, faster reading—every time.

★ Simple, direct operation of the Alnor Dewpointer assures laboratory accuracy by non-technical personnel. Substantial carrying case protects it against the usual hazards of portable use.

★ Available in three ranges—for dew points between minus 20 deg. F. and room temperatures, from minus 80 deg. F. to 0 deg. F., and from -80 deg. F. to room temperature.

Write for Descriptive Bulletins. Illinois Testing Laboratories, Room 518, 420 N. La Salle St., Chicago 10, Ill.

Alnor PRECISION INSTRUMENTS FOR EVERY INDUSTRY

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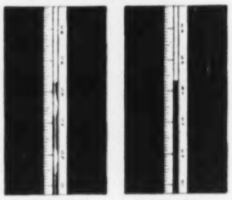

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QUICK, CLEAR READINGS ON BLACK-READING, WHITE-BACK MERCURY THERMOMETERS

All the advantages of mercury are now combined with the clear visibility of black-on-white. On new QUIKSITE thermometers you can take fast, reliable temperature readings without the confusing reflections normally associated with mercury.

With black-reading QUIKSITE the image is clear and sharp—black against white—no reflections, no glare, no errors. Send for Catalog 19-A, describing hundreds of H-B precision instruments. H-B Instrument Co., American & Bristol Sts., Philadelphia 40, Pa.

ANOTHER H-B FIRST!

QUIKSITE BLACK-READING MERCURY THERMOMETERS

For more information circle **268** on inquiry card.

Booth No.

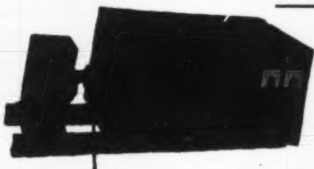
Penn Industrial Instrument Corp., Philadelphia 4, Pa. 513
Exhibiting: New Products—Btu meter; telephone line transmitter; compensated electronic flowmeters; low differential transmitter; pneumatic indicating transmitters for temperature, pressure, flow and motion; straight-through Linameter; wide-range electronic meter. **Regular Products**—Flowmeters; controllers; pneumatic instrumentation; feed-water regulators; primary elements.

Perkin-Elmer Corp., Norwalk, Conn. 907, 909
Exhibiting: New Products—Infrared microscope attachment; potassium bromide die, for pressing infrared sampling disks. **Regular Products**—Spectrophotometers; spectrometer; Tri-Non analyzer; bichromator analyzer.

Permutit Co., Ranarex Div., New York 36, N. Y. 420
Exhibiting: New Products—Gas analyzers with remote indicating and recording or complete automatic control. **Regular Products**—CO2 meters; specific gravity instruments; furnace atmosphere analyzers; gas analyzers.

Phillips Control Corp., Joliet, Ill. 1716
Exhibiting: New Products—Sensitive multi-contact relay utilizing twin contacts. **Regular Products**—Relays; actuators; controls.
See ad on page **1120**. Circle **5** on inquiry card.

Phoenix Precision Instrument Co., Philadelphia 40, Pa. 1720, 1722
Exhibiting: New Products—Light-scattering photometer; differential refractometer; automatic-recording differential refractometer; dual photomultiplier-type photometer; electron multiplier photometer; forward-scattering aerosol and smoke photometer. **Regular Products**—Maple syrup and honey comparators; flowmeters and tubes; manometers; glass pumps, valves, tubing (precision-bore), etc.; colorimetric absorption cells.



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MEASURES ABSOLUTE TURBIDITY, DISSYMMETRY AND DEPOLARIZATION OF DILUTE SOLUTIONS OF HIGH MOLECULAR-WEIGHT COMPOUNDS.

Phoenix Precision Instrument Co.
3803-05 N. 5th St., Philadelphia 40, Pa.

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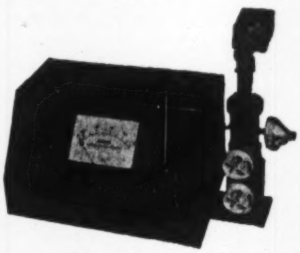

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The forward scattering principle offers the most practical, intelligent method of accurate air pollution studies, measurements and means of control, yet has numerous other applications.

Phoenix Precision Instrument Co.,
3803-05 N. Fifth St., Philadelphia 40, Pa.

For more information circle **270** on inquiry card.

Photochemical Products, Inc., New York 51, N. Y. 338
Exhibiting: New Products—Printed circuit, new type etching. **Regular Products**—Printing of dials, panels, nameplates, schematic diagrams.

Polymer Corp. of Pennsylvania, Reading, Pa. 1152
Exhibiting: New Products—Teflon insulated spagetti tubing; A-200.5, plastic for UHF insulator. **Regular Products**—Nylon and Teflon in rod, strip, tubing, disk and slab; Nylasint finely-divided nylon powder.

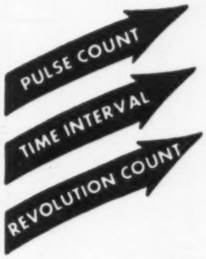
Potter Aeronautical Co., Union, N. J. 115
Exhibiting: New Products—Mass flowmeter; predetermining counter; flow digitizer; wide-range flowmeter; electronic totalizer; airborne flowmeters. **Regular Products**—Flow sensing element; lab-type frequency converters; tachometers; flowmeters; high-pressure and temperature flow sensors.

Potter Instrument Co., Inc., Great Neck, N. Y. 1141
Exhibiting: New Products—Digital magnetic tape handler; megacycle preset interval generator; general-purpose interval timer. **Regular Products**—Counter chronograph; frequency-time counter; predetermined counters; relay translation matrix and printer; totalizing counters; plug-in components.

Precision Thermometer & Instrument Co., Philadelphia 30, Pa. 347
Exhibiting: Mercurial barometers and vacuum gages; laboratory and industrial thermometers; psychrometers; hydrometers; hygrometers; Princo Densitrol.
See ad **272** →

Process Controls Div., Baird Associates, Cambridge 38, Mass.
.... 660, 662
Exhibiting: Plant stream analyzer (infrared absorption type) for liquids and gases.

LET *Ametron* RECORDERS
SOLVE **YOUR** COUNTING PROBLEMS



for ANY counting or timing job!

Ametron Recording Counter

Consists of two basic electrical circuits, both normally open. Momentary closure of the counting circuit advances indexing device one step. Momentary closure of print circuit causes unit to print accumulated count. Automatic reset to zero available if desired. A wide variety of timing mechanism available as standard equipment.

This unit may also be furnished to record elapsed time in these increments: 1/10 minute, 1/100 minute, 1 second and 1/10 second. Counting unit may also be equipped for direct drive from a rotating shaft to count revolutions in units of one tenth.

Write for circular RC 13.

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MEASURE, CONTROL
LIQUID DENSITY
continuously and automatically
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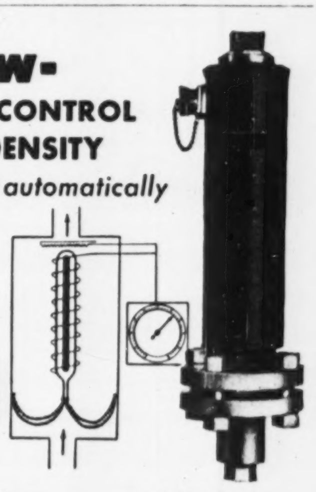

Process industries will welcome the new DENSITROL—the precision instrument that gives a continuous reading of density in flowing liquids such as sugar syrups, brine, acids. DENSITROL electrical indicators or recorders can be located remote from the sampling chamber itself. If desired, DENSITROL can be linked with control mechanisms for automatic regulation. For information on temperature and pressure ranges, calibrations, and other specifics, request Bulletin W-3.

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THERMOMETER & INSTRUMENT CO.
1434 Brandywine Street, Philadelphia 30, Pa

Makers of precision-built thermometers, barometers, hydrometers, gauges, indicators, mercury in glass thermo-regulators.

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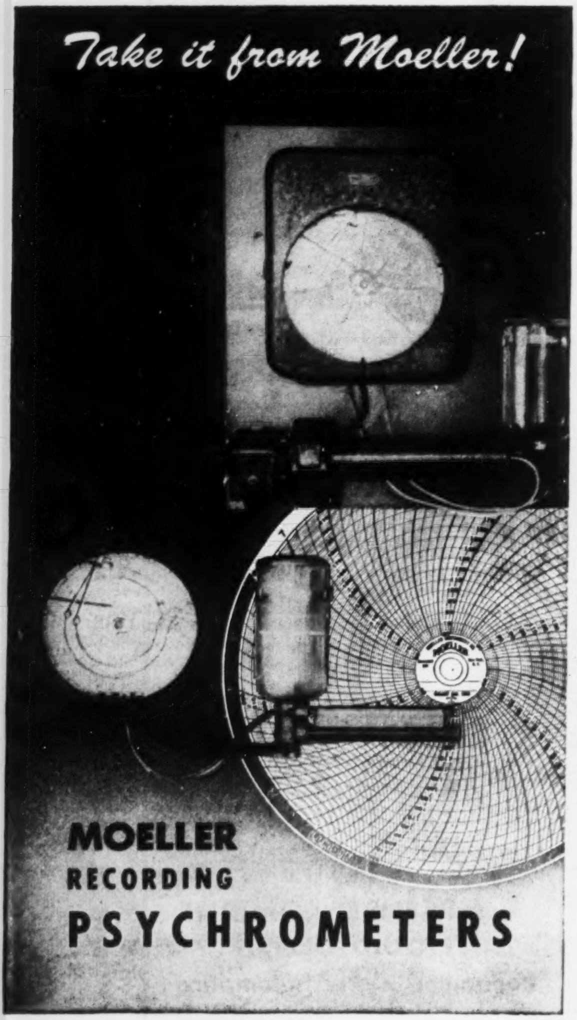

Correctly designed and reliable in every detail, these improved, streamlined recording psychrometers offer the best in craftsmanship. Reliability has been outstanding in Moeller instruments, which have been serving industry faithfully since 1867.

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Representatives in Principal Cities

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Booth No.

Professional Instrument Corp., New Haven 11, Conn. 306
Exhibiting: New Products Automatic sample computer for measuring radioactive or tracer sample; glow transfer decade scaler. **Regular Products**—Devices for measuring radioactivity.

Proportioneers, Inc., Providence 9, R. I. 801, 803
Exhibiting: New Products—Solenoid-actuated adjustable feeder; differential blending unit; loss-in-weight gravimetric feed control system. **Regular Products**—Two-component blender; feed controllers.

Publishers Authorized Binding Service, Chicago 6, Ill. 1115

Radio Corp. of America, Camden, N. J. 213, 215, 217
Exhibiting: New Products—Electron microscope; industrial TV; water-cooled lens system, protective housings, pan and tilt mechanisms, camera switching unit.

Rapid Electric Co., New York 61, N. Y. 543
Exhibiting: New Products—Regulated power supplies, 3-phase, and single phase; manually-controlled power pack. **Regular Products**—D-c. power supplies.

Raytheon Mfg. Co., Waltham 54, Mass. 331, 333
Exhibiting: New Products—Transistor-magnetic servo amplifier supplying 35 watts to control phase of two-phase motor; ultrasonic cleaning equipment. **Regular Products**—Ultrasonic machine tool; voltage stabilizers; Raytheon knobs.

J. B. Rea Co., Inc., Santa Monica, Calif. 922
Exhibiting: New Products—High-speed analog-to-digital converter, up to 8000 conversions/sec.

Reinhold Publishing Corp., New York 22, N. Y. 1018, 1020

Reliance Electric & Engineering Co., Cleveland 10, Ohio 953, 955
Exhibiting: New Products—Packaged electronic circuits; dual-cooled and explosion-proof motor; VSR electronic motor-drive regulator; new a-c. motors. **Regular Products**—Operating display of adjustable-speed drive with flow meters and electronic regulator.

RELIANCE V★S DRIVE
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SEALPAK UNIT—Compact, sealed electronic circuit package

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1039 Ivanhoe Road • Cleveland 10, Ohio, U. S. A.
D-57

For more information circle **274** on inquiry card.

Republic Flow Meters Co., Chicago 47, Ill. 452, 454, 456, 458
Exhibiting: New Products—High torque control drive, with pneumatic or electronic master signal receiving unit. **Regular Products**—Valves; transmitters; draft gages; test equipment.
See ads on pages **1150-1151**. Circle **28** on inquiry card.

Republic Mfg. Co., Cleveland 2, Ohio 415
Exhibiting: New Products—Low-temp. selector valve; free-flow check valve; high pressure selector valve; adjustable pressure gage snubbers. **Regular Products**—Valves: air, vacuum, oil, water, gases, fuel.

Research Controls, Tulsa, Okla. 502, 504, 506
Exhibiting: New Products—Extreme-pressure small-flow diaphragm-operated control valves; new topworks design; small-flow relief valves and regulators. **Regular Products**—Miniature diaphragm, rubber pinch, pH, bellows seal valves; valves for chemical service; pneumatic relays.

Revere Corp. of America, Wallingford, Conn. 1818
Exhibiting: New Products—Printed circuits and assemblies; pneumatic and hydraulic valves; electronic weighing equipment. **Regular Products**—Fuel flow transmitters; switches; aircraft fuel system components; thermocouple wire; high-temperature wire; intervalometer and timer.

Roanwell Corp., Brooklyn 17, N. Y. 1240
Exhibiting: New Products—Air gaging comparator, for coating-thickness variations of materials being coated; surface indicator, accessory to indicate and record minute caliper variation in continuous-sheet traverse sections. **Regular Products**—Micro recording comparator.

Robinson Aviation, Inc. Teterboro, N. J. 814
Exhibiting: New Products—All-metal vibration isolators for mounting electronic equipment. **Regular Products**—Vibration isolation and shock control systems, units, and devices.

ROBINSON AVIATION INC.
TETERBORO NEW JERSEY
Vibration Control Engineers

For more information circle **275** on inquiry card.

Booth No.

I. E. Robinson Co., Upper Darby, Pa. 436
Exhibiting: New Products Electronic counters; industrial TV; vacuum-tube voltmeter; meter calibrators; electrostatic voltmeters. **Regular Products**—Pilot relay and liquid level controls; voltage regulators; electronic tachometer; VAW meter.

Rochester Mfg. Co., Inc., Rochester 10, N. Y. 523
Exhibiting: New Products—1-in. dial pocket thermometer; 6-in. industrial bimetallic thermometer. **Regular Products**—Stainless dial thermometers; separable sockets; magnetic liquid level gages.

W. S. Rockwell Co., Fairfield, Conn. 446
Exhibiting: New Products—Diaphragm pumps, to 10 gpm. at 60 psi.; lubricated swing slide valve; swing check valve. **Regular Products**—Butterfly, slide, and Kwikleen valves.
See ad on page **1284**. Circle **138** on inquiry card.

Rodon, Inc., Neshaminy, Pa. 321
Exhibiting: New Products—Motor-driven variable-speed reversible cable reel. **Regular Products**—Medical and laboratory test equipment; electrochemical equipment and assemblies; special instrumentation.
See ad on page **1248**. Circle **88** on inquiry card.

Rohde and Schwartz, Munich, Germany. (see Federal Telephone and Radio Company, Booths 202-204)

R-S Products Corp., Philadelphia 44, Pa. 819, 821, 823, 825
Exhibiting: Butterfly valves; strainers; shock absorbers; level control system.

Rubicon Company, Philadelphia 32, Pa. 1015, 1017
Exhibiting: New Products—Six-dial Thermofree potentiometer; precision voltage divider; portable precision potentiometer; recording automatic H_2S analyzer. **Regular Products**—Precision potentiometer; galvanometers; Mueller, Wheatstone and Kelvin bridges; resistors; resistance boxes; Evelyn photoelectric colorimeter.

Rutherford Electronics Co., Culver City, Calif. 252
Exhibiting: New Products—Pulse and square-wave oscillator. **Regular Products**—Time delay generators; pulse generator; pulse train calibrator.

Sanborn Company, Cambridge 39, Mass. 232, 234
Exhibiting: Multi-channel oscillographic recording systems; interchangeable preamplifiers for use with analog computers; single and two-channel recording systems.
See ad on page **1211**. Circle **49** on inquiry card.

Schaevitz Engineering, Camden 1, N. J. 1812
Exhibiting: New Products—Rotary acceleratory; indicator for differential transformers. **Regular Products**—Accelerometers; differential transformers.

Schutte & Koerting Co., Cornwells Heights, Bucks County, Pa. 810, 812
Exhibiting: New Products—Rotameter for safety flow measuring. **Regular Products**—Indicating, electric and pneumatic transmitter-type, chemical, and armored rotameters; alarm and purge meters; flow indicators.

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you buy . . .

SPECIFY

I.I.C. non freezing meter bearings*

*Foxboro
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*Emco
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*and others

Remember . . . the heart of any meter is the bearing—and NO BEARING COMPARES WITH THE I. I. C. non-freezing bearing for accuracy and years of trouble free service. Ask the men who use them!

*The I. I. C. stainless steel bearing is manufactured as replacement for Brown, Emco, Foxboro, Metric and Taylor meters and for many other special applications.

No matter whose meter you buy, specify the free-floating non-freezing I. I. C. bearing, guaranteed to be the answer to leaking, friction and corrosion—built to withstand most severe operating conditions. This meter bearing requires no lubrication, or shaft end thrust adjustment. It operates easily without diminishing returns at the extremes, gives pin-point accuracy entirely out of the range of ordinary bearings.

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This is not a Teflon bearing.

Write for Bulletin 52-R.

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BOX 1909 ODESSA, TEXAS

For more information circle **277** on inquiry card.

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THE representatives of the British Scientific Industry exhibiting at the First International Instrument Congress at Philadelphia extend a hearty welcome to all American instrument users to visit stands Nos. 337, 339, 341, 343 and 345.

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BAIRD & TATLOCK (LONDON) LTD.

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Exhibiting :

B.T.L. Hotplate Magnetic Stirrer.
Ultrasonic Generator.

C. BAKER OF HOLBORN LTD.

Manufacturers of Precision Optical Instruments,

Metron Works,
Purley Way, Croydon,
Surrey, England.
Telephone No. Croydon 6644 and 9822.

Exhibiting :

Double Refracting Interference Microscope.

R. & J. BECK LTD.

Manufacturers of Optical Instruments,

69/71, Mortimer Street,
London, W.1, England.
Telephone No. MUSeum 9696.

Exhibiting :

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CHANCE BROTHERS LIMITED

Manufacturers of Optical and Special Glasses for over 100 years,

Smethwick, Birmingham, England. Telephone No. West Bromwich 1824.

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Distributors : Microscope Cover Glasses :
Arthur H. Thomas Co., 230 South Seventh St.,
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Optical glasses in wide variety. Glass blanks for wind tunnel windows, also high refractive index rare earth glasses. Borate flint glass for reduced secondary spectrum and barium crowns made by the platinum pot process. A variety of filter glass types, including ultra-violet transmitting glass and thermally toughened heat-absorbing glass. Microscope cover slips.

ELECTRO METHODS LTD.

Manufacturers of Scientific Instruments and Precision Electrical Apparatus,

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Telephone No. Stevenage 780/1

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Low-Inertia Integrating Motors. Low-Inertia Integrating Motors with Counter. Educational Magnetic Amplifier. Miniature Polarised Relay.

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Exhibiting :
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Manufacturers of Selenium Photo-Cells and Photo-Electric Apparatus,

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FLEMING RADIO (DEVELOPMENTS) LTD.

Manufacturers of Custom-built Precision Electrical/Electronic Equipment,

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Telephone No. Stevenage 804/5/6.

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2 Decade Logarithmic Ratemeter.
Probe Unit. Fast Multiple Pulse Generator.

FOSTER INSTRUMENT CO. LTD.

Manufacturers of Electrical Resistance, Thermoelectric, Optical and Radiation Pyrometers, Deflectional, Potentiometric and Electronic types in Indicating, Recording and/or Controlling forms and Introscopes,

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Agents : The Anglo-American Scientific Import-Export Corporation,
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Exhibiting :
Circular Wall Type Temperature Indicator (permanent magnet moving coil system type). Teloscale Electrical Resistance Thermometer Temperature Indicator with illuminated projected scale. Introscope (for internal inspection) with four interchangeable heads (forward oblique view, retrograde oblique view, direct forward view, and forward circular (annular) view).

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Nivoc House, Ealing Road, Alperton,
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Exhibiting :
Automatic Aperiodic Balance. Nivoc Spectrometer. Nivoc Plastic Filter Pump. Thumb-wheel and Thumb-screw Clamps. Single Screw Bosshead. Laboratory Bosshead.

For more information on (Baird & Tatlock) 278, (Baker) 279, (Beck) 280, (Chance) 281, (Electro) 282, (Elliott) 283, (Evans) 284, (Fleming) 285, (Foster) 286, or (W. & J. George & Becker) 287, circle number on inquiry card.

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Visitors to the stands to see these novel exhibits will also find information on nearly three thousand instruments now available from British sources.

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Telephone No. TEMple Bar 2621. Telegrams : Gramme, Westcent, London.
Agents: Anglo-American Scientific Import-Export Corporation,
185 Devonshire Street, Suite 614,
Boston, Mass.
Tel. No. Hubbard 2-7112. Cables—Anglamsci, Boston.

Exhibiting :
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MERVYN INSTRUMENTS

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Telephone No. Bolton 3588

Exhibiting :
Interferometer.

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Manufacturers of Precision Instrumentation for Industrial,
Marine and Traction Applications,
Chronos Works, North Circular Road,
London, N.W.2, England.

The Industrial Instrument Division of S. Smith & Sons (England) Ltd.
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Exhibiting :
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Precision Balance Manufacturers,
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Semi-automatic, projected reading, analytical balance.
Capacity : 200 g. Sensitivity : 0.1 mg.
Fully automatic, aperiodic, projection reading balance.
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J. W. TOWERS & CO. LTD.

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Thermostat Bath with Viscometer Holders and Ubbelohde Viscometers. Strip Action Still. Melting Point Apparatus. Miniature Immersion Pump. Macerater. Vacuum Oven.

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Manufacturers of Precision Cathode Ray Tubes, Geiger Counter Tubes,
Proportional Counters and Boron Trifluoride Neutron Counters,
Centronics Works, New Addington,
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Agents : Nuclear Instrument & Chemical Corporation, 223–233 West Erie Street, Chicago, Illinois. Manhatten Commerical Corporation, 366 Broadway, New York, 13. Atomic Center for Instruments & Equipment, Inc., 489 Fifth Avenue, New York 17. Atomic Instrument Co., 84 Massachusetts Avenue, Cambridge, 39, Massachusetts.

Exhibiting :
Geiger Counter Tubes.
Precision Cathode Ray Tubes.

UNICAM INSTRUMENTS LTD.

Manufacturers of Instruments for Spectroscopy and Crystallography,

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Agents for Crystallographic Apparatus:
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Exhibiting :
Ultraviolet and Visible Spectrophotometers.
Goniometers,
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WRAY (OPTICAL WORKS) LIMITED

Manufacturers of Precision Cameras, Photographic Lenses,
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Exhibiting :
Photographic lenses for Cathode Ray Recording and Radiography. Wrayflex Precision Miniature Camera.

For more information on (Griffin & Tatlock) **288**, (Isotope) **289**, (Mervin) **290**, (Northern Scientific) **291**, (Smiths) **292**, (Stanton) **293**, (Towers) **294**, (Townson & Mercer) **295**, (20th Century) **296**, (Unicam) **297**, or (Wray) **298**, circle number on inquiry card.

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England's first name in Photo-electric and Electronic controls.

The largest manufacturers in the United Kingdom of smoke density indicators and recorders—the agreed first essential for continuous smoke-controlled combustion and consequent freedom of air pollution.

Twenty-six years experience

List of customers includes the largest industrial companies and the nationalised industries.

Radiovisor Parent Ltd., offers the benefit of its experience and its connections to an approved American Company that wishes to manufacture and to market its products in the United Kingdom.

Chairman of the Company, Mr. C.R.C. Marlow, is visiting the Exposition from September 15th-September 22nd inclusive, and will be available each day to discuss such a proposal by appointment on the stand of the Scientific Instrument Manufacturers Association of Great Britain.

For more information circle 299 on inquiry card.

Booth No.

Scientific Instrument Co., Detroit 26, Mich. 1518

Exhibiting: New Products—Industrial thermometer; laboratory instruments for altitude and d/p readings. **Regular Products**—Thermometers; industrial, dial, recording; controllers; pressure gages; viscosimeters; altimeter and d/p gages.

Scientific Instrument Mfrs.' Assn. of Great Britain, Ltd., London W. I. Eng. 337, 339, 341, 343, 345

Baird & Tatlock (London) Ltd., Chadwell Heath, Essex. Exhibiting: Hotplate magnetic stirrer; ultrasonic generator.

Circle **278** on inquiry card.

C. Baker of Holborn, Ltd., Croydon. Exhibiting: Double refracting interference microscope.

Circle **279** on inquiry card.

R. & J. Beck, Ltd., London W. 1. Exhibiting: Reflecting microscope.

Circle **280** on inquiry card.

Chance Brothers, Ltd., Birmingham, Eng. Exhibiting: Optical glasses; blanks; rare earth glasses; Borate flint glass; Filter glass, including ultraviolet transmitting, and heat absorbing; microscope cover slips.

Circle **281** on inquiry card.

Electro Methods, Ltd., Stevenage, Hertfordshire. Exhibiting: Low-inertia integrating motor, with and without counter; magnetic amplifiers; miniature polarized relay.

Circle **282** on inquiry card.

Elliott Brothers (London) Ltd., London S. E. 13. Exhibiting: Ac/dc comparator; 10-channel strain display equipment; torque vane wattmeter; 3-channel wind tunnel strain gage; stabilized frequency power generator.

Circle **283** on inquiry card.

Evans Electroselenium, Ltd., Harlow, Essex. Exhibiting: Flame photometer; electrophoresis apparatus.

Circle **284** on inquiry card.

Fleming Radio (Developments) Ltd., Stevenage, Hertfordshire. Exhibiting: 2-decade logarithmic ratemeter; probe unit; pulse generator.

Circle **285** or **300** on inquiry card.

Foster Instruments Co., Ltd., Letchworth, Eng. Exhibiting: Temperature indicator; electrical resistance thermometer; internal inspection scope.

Circle **286** on inquiry card.

W. & J. George & Becker, Ltd., Wembley, Middlesex. Exhibiting: Automatic aperiodic balance; spectrometer; plastic filter pump; thumbwheel, thumb-screw clamps; single screw bosshead; laboratory bosshead.

Circle **287** on inquiry card.

Griffin & Tatlock, Ltd., Kingsway, London W. C. 2. Exhibiting: Courtauld atomic models; space-filling atomic model with elastically-distortable valancy angles.

Circle **288** on inquiry card.

Isotope Developments, Ltd., Beenham Grange, Aldermaston Wharf, Reading. Exhibiting: Ionization anemometer; package monitor.

Circle **289** on inquiry card.

Mervyn Instruments, Working, Surrey. Exhibiting: New infrared grating spectrometer.

Circle **290** on inquiry card.

Northern Scientific Equipment, Ltd., Bolton, Lancashire. Exhibiting: Interferometer.

Circle **291** on inquiry card.

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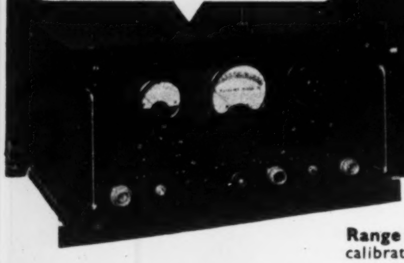
INSTRUMENT EXPOSITION
September 15 - 21
S.I.M.A. Stand No. 337 - 345

Fleming
LOGARITHMIC RATEMETER
developed in collaboration with Harwell Atomic Energy Research Establishment



The logarithmic calibration ensures constant scale accuracy at all readings, together with a wide range of counting rates without the necessity of range switching.

If you need unattended equipment for recording widely fluctuating counting-rates, use the Fleming Ratemeter — unique in conception, pre-eminent in performance.

SPECIFICATION

Range 10-1000 pulses per sec. on 3½" logarithmically-calibrated meter.

Self-contained power supplies including E.H.T. for Geiger-Muller tubes; may be adjusted between 900-1,500 volts by means of pre-set control. Power supplies available for Probe unit (quench amplifier).

Input pulse should be positive going and of approx. 30 volts amplitude.

Output socket provided for recorder—instruments of 5 milliamps FSD or 100 millivolts FSD.

Power supply: 110 volts or 200-250 volts a.c. 40-60 c/s.

FOR KEEN PRICES & PROMPT DELIVERY contact...
Fleming
RADIO (DEVELOPMENTS) LTD.
Manufacturers of SPECIALIST ELECTRONIC INSTRUMENTS
STEVENAGE, HERTS, ENGLAND, U.K. Cables Stevenage 804, Herts, U.K.

For more information circle 300 on inquiry card.

BRITISH MADE motors & geared units by FRACMO

In addition to all types of small electrical motors from 1/250—¼ H. P.

WE SPECIALIZE

In small industrial geared units speeds ⅛—600 R.P.M. Torques 1½—250 LBS/ins.

★Comprehensive Catalogue on request.

FRACTIONAL H. P. MOTORS LIMITED
Rookery Way Hendon N.W.9. England
Cables: FRACMO LONDON.

For more information circle 301 on inquiry card.

Booth No.

Smiths Industrial Instruments, Ltd., London N.W. 2. Exhibiting: Hand tachometer.

Circle **292** on inquiry card.

Stanton Instruments, Ltd., London W. 1. Exhibiting: Semi-automatic projected-reading analytical balance; automatic aperiodic balance; micro balance.

Circle **293** on inquiry card.

J. W. Towers & Co., Ltd., Widnes, Lancashire. Exhibiting: Automatic direct-reading balance; automatic fraction collector.

Circle **294** on inquiry card.

Townson & Mercer, Ltd., Croydon. Exhibiting: Thermostat with viscometer holders and Ubbelohde viscometer; strip action still, melting point apparatus; miniature immersion pump; macerater; vacuum oven.

Circle **295** on inquiry card.

20th Century Electronics, Ltd., New Addington, Surrey. Exhibiting: Geiger counter tubes; precision cathode-ray tubes.

Circle **296** on inquiry card.

Unicam Instruments, Ltd., Cambridge. Exhibiting: Ultraviolet and visible spectrophotometers; goniometers; powder cameras.

Circle **297** on inquiry card.

Wray (Optical Works) Ltd., Bromley, Kent. Exhibiting: Photographic lenses for cathode-ray recording and radiography; precision miniature camera; press camera.

Circle **298** on inquiry card.

Everett, Edgecumbe & Co., Ltd., London N.W. 9. Exhibiting: Train speed recorder.

Singer Instrument Company, Ltd., Reading, Berkshire. Exhibiting: High-power micromanipulator; low-power microdissector.

Rich. Seifert & Co. Rontgenwerk, Hamburg 13, Germany 236

Exhibiting: New Products—X-ray diffraction unit; goniometer; instrument for stress measurement in metals; spot-ray-apparatus. **Regular Products**—Industrial x-ray equipment; diffraction cameras.

Servo Corp. of America, New Hyde Park, N. Y. 1143

Exhibiting: New Products—High-voltage power supply; Type 1340 bolometers; radiation pyrometer; servoscope (0.2 to 60 cps.). **Regular Products**—Servoscope; servoboard; servo amplifiers; bolometers and associated instrumentation; signal and spectrum generators.

See ad on page **1284**. Circle **139** on inquiry card.

Servo-Tek Products Co., Hawthorne, N. J. 1060, 1062

Exhibiting: New Products—Adjustable speed drives. **Regular Products**—Permanent magnet d-c. motors nad tachometer generators; ultrasensitive electronic relays; constant reference voltage supply; d-c. amplifier.

Shallcross Mfg. Co., Collingdale, Pa. 427, 429

Exhibiting: New Products—Decade voltage divider; current tester; Wheatstone bridges; galvanometers; capacitor analyzer; transmission tester; magnetic test bridge. **Regular Products**—Resistors; switches, attenuators; delay lines.

See ad on page **1259**. Circle **106** on inquiry card.

Sheffler-Gross Co., Philadelphia 6, Pa. 720

Exhibiting: Sales engineers for Buffalo Meter Co., Homestead Valve Mfg. Co., Liquidometer Corp., McAlear Mfg. Co.; Bridgeport Thermostat Div.; Fielden Instrument Div.; Fulton Sylphon Div.

Sherman Electric Co., Inc., Warren, Ohio 952, 954

Exhibiting: Thermocouple circuit restorer for protection against failures of thermocouple circuits; Leak-checker for thermocouple protection tubes.

Sigma Instruments, Inc., South Braintree 85, Mass. 428, 430

Exhibiting: Relays—miniature, very high-speed, telegraph, differential, high current, and 3-position center-neutral.

Skinner Chuck Co., Electric Valve Div., New Britain, Conn. 447

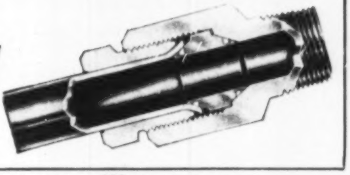
Exhibiting: Solenoid valves.

S. Morgan Smith Co., York, Pa. 819, 821, 823, 825

Exhibiting: Butterfly, roto, and non-lubricated cone type valves; package accumulator system; poppet type safety valves; Howell Bunger valves.

Special Screw Products Co., Bedford, Ohio 658

Exhibiting: Corrosion-resistant flared tube fittings; corrosion-resistant valves.



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STAINLESS STEEL
TUBE FITTINGS

Only Koncentrik Fittings give you double protection against dangerous line leaks, with two positive seals . . . metal-to-metal *and* Teflon. Write for Bulletin K-151 today.

THE
SPECIAL SCREW
PRODUCTS CO.
5445 DUNHAM RD.
BEDFORD, OHIO.

For more information circle **302** on inquiry card.

Specialized Instruments Corp., Belmont, Calif. 1026

Exhibiting: New Products—Paper electrophoresis system; developments in ultracentrifugation. **Regular Products**—Analytical and preparative ultracentrifuges; electrophoresis-diffusion apparatus.

Standard Electric Time Co., Springfield 2, Mass. 442, 444

Exhibiting: New Products—Fluid network analyzer. **Regular Prod-**

IT'S NEW

GRAYHILL
Series 24
Miniature
Tap Switch

with
IMPROVED
DETENT ACTION!

- Available 1 to 6 Decks
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RETAINS ALL THE FEATURES OF THE SERIES 5000 AND SERIES 12 . . . *PLUS MORE* POSITIVE DETENT AND BETTER ACTUATING "FEEL". SLIGHTLY LONGER BEHIND PANEL LENGTH TO ACCOMMODATE NEW DETENT DESIGN AT THE FRONT OF SWITCH (SHAFT END).

Grayhill
517 Hillgrove Avenue
La Grange, Illinois
Phone: Fleetwood 4-1040

For more information circle **303** on inquiry card.

New! Gow-Mac Gas Purity

ANALYZER-RECORDER

Industrial Panel Instruments for Plant Stream and Laboratory to monitor various mixtures and trace impurities such as:

99.5-100% Argon ±.005%
99.0-100% Oxygen ±.01%

featuring:

- ELECTRONIK RECORDER
- FLOW REGULATORS AND METERS
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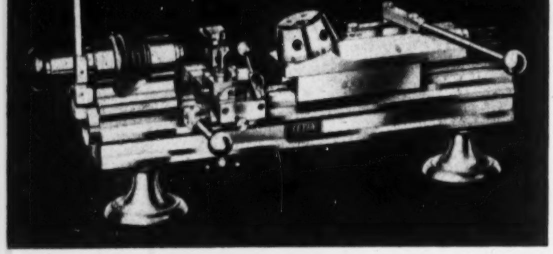

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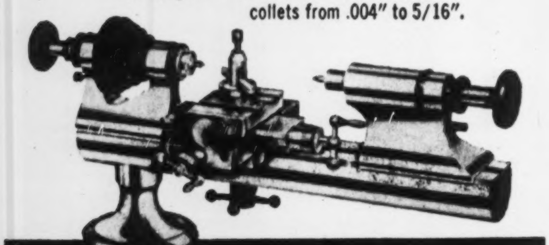

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ucts—Paging and annunciator systems; electric clocks; laboratory electrical distribution systems.
See ad on page **1333.** Circle **169** on inquiry card.

Herman H. Sticht Co. Inc., New York 7, N. Y. 406
Exhibiting: New Products—Vibrating reed tachometers; vibrating frequency meters; single-knob measuring bridge; electrostatic neutralizer bars. **Regular Products**—Insulation testers; hand and stationary tachometers; slide-wire rheostats; stop watches; timers.
See ad on page **1240.** Circle **77** on inquiry card.

Streeter-Amet Co., Chicago 13, Ill. 1619, 1621
Exhibiting: New Products—Digitizing telemetering unit. **Regular Products**—Digitizers; pulse counting instruments; electronic weighing devices.
See ad on page **1195.** Circle **271** on inquiry card.

Superior American Fire Alarm Co., Meriden, Conn. 1814, 1816
Exhibiting: Municipal and industrial fire alarm systems; fire alarm boxes; control consoles; signal devices; components for alarm systems.

Superior Electric Co., Bristol, Conn. 721, 723, 725
Exhibiting: Variable transformers and automatic voltage regulators.
See ad on page **1159.** Circle **35** on inquiry card.

Surprenant Mfg. Co., Boston, Mass. 233
Exhibiting: New Products—High temp. aircraft and missile wires, and hook-up wire to spec. Mil-W-1687A. **Regular Products**—Insulated wire, cable, and insulation for electronics and aircraft industries.

Swartout Company, Cleveland 12, Ohio 625, 627, 629
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See ad on page **1207.** Circle **46** on inquiry card.

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Swedish Consolidated Exhibit 312, 314, 316, 318, 320, 322, 324

Allmanna Svenska Elektriska AB, Asea, Vasteras. Exhibiting: New Products—Metal detectors; magnetic torque indicator; magnetic pressure transmitter. **Regular Products**—Transductor current meter; automatic diffusion pump.

AB Gasackumulator. AGA, Stockholm-Lidingo. Exhibiting: New Products—Combined horizon and direction indicator for aircraft; instrument for indicating and maintaining respiration of infantile paralysis patients.

AB Elema, Stockholm-Hagalund. Exhibiting: New Products—Recorded with liquid jets; strain gage equipment.

Telefon AB L.M. Ericsson, Stockholm 32. Exhibiting: New Products—Multi-recorder, to measure function of group of relays; chronograph.

L.M. Ericssons Matinstrument AB, Ermi, Ranhammarsvagen 20, Ulvsunda. Exhibiting: New Products—Calibration compensator for electrical instruments. **Regular Products**—Toroid galvanometer; supersensitive relay; compensators; automatic fuse and switch; phase-sequence indicator.

AB C.E. Johansson, Eskilstuna. Exhibiting: New Products—Microscope for surface roughness testing. **Regular Products**—Extensometers; surface roughness indicator; micro hardness tester; sensitive length gage.

Svenska Ackumulator AB Jungner, Stockholm 14. Exhibiting: New Products—Profile projector. **Regular Products**—Interferometer; autocollimator; stereo microscope; glass thickness gage; remote transmitting elements; SAL ship's log.

LKB-Produkter Fabriks AB Stockholm 12. Exhibiting: New Products—Column electrophoresis equipment; filter columns; fraction collector, senior. **Regular Products**—Polarograph; paper electrophoresis equipment; fraction collector, junior; ultra-microtome; robot scaling equipment; mechanical register; hot-wire vacuum gage; conductivity bridge.

Svenska Kullagerfabriken, SKF, Goteborg. Exhibiting: Adjustable block gage; gage sets for cylindrical holes; thread measuring equipment.

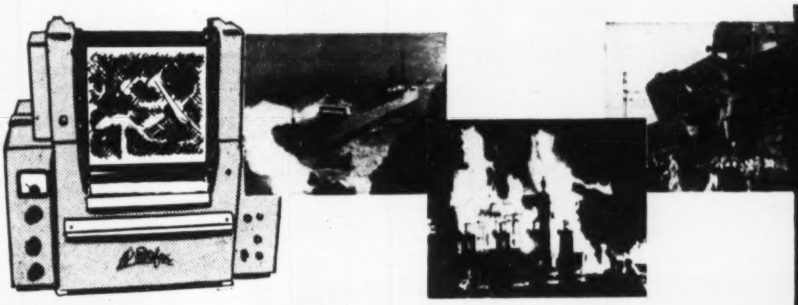
Svenska Turbin AB Ljungstrom, Stal, Finspang. Exhibiting: New Products—Vibration indicator.
AB Alpha, L.M. Ericsson. Exhibiting: Ductilometer.

Swiss American Jewel Bearing Co., Sphinx American Co., Woodside 77, N. Y. 656
Exhibiting: Precision screw machine products; precision drills; gears and pinions; hairsprings; jewel bearings.

Swiss Jewel Company-Deltavis Co. S. A., Philadelphia 6, Pa. 809
Exhibiting: Jewel bearings; sapphire products; precision screw machine parts.

Taller & Cooper, Inc., Brooklyn 1, N. Y. 344, 346
Exhibiting: New Products—Sensitive gas analyzer; carbon monoxide detector; automatic monitoring system. **Regular Products**—Digital converters.
See ad on page **1275.** Circle **125** on inquiry card.

Taylor Dynamometer & Machine Co., Milwaukee 13, Wis. 350
Exhibiting: Hydraulic dynamometer; precision drilling machine; balancing machine.



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Similarly through helix recording you have the "flying spot" point of continuous contact with the paper. The "flying spot" moves continuously from left to right as the paper is advanced line by line. Since no recording takes place except when the current flows, it is obvious that varied inputs and phenomena can all be fed into common electrodes with virtually no limitation as to their number, their time variation, the intensity or their character. Thus in many instances where it was necessary to build special recorders for special applications, now a single recorder can get all this information in a small space and record it all relative to time, in equipment that is extremely simple, without adjustments, and which can be operated remote without attention.

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*Alden patents granted and pending.

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Booth No.

Taylor Instrument Cos., Rochester 1, N. Y. 544, 546, 548, 550
Exhibiting: New Products Timed-program controller; volumetric load motor; computing relay. **Regular Products** Graphic panelboard, recording pressure and pneumatic-set recording receiver controllers; differential pressure and temperature transmitters; indicators; recorders; controllers.
See ad on pages **1152-1153**. Circle **29** on inquiry card.

Technical Charts, Inc., Buffalo 10, N. Y. 717, 719
Exhibiting: Recording instrument charts, dial, roll and rectangular.
See ad on page **1280**. Circle **133** on inquiry card.

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TECHNICAL CHARTS, Inc. BOOTH 717, 719

For more information circle **309** on inquiry card.

Techniflex Corporation, Port Jervis, New York 255, 257
Exhibiting: New Products Zero plugging system, instantaneous electronic brakes for a.c. and d.c. motors; electric valve operators for use with instrument controls. **Regular Products** Electric valve operator; zero-plugging systems. Level controls; relay.

Tektronix, Inc., Portland 7, Ore. 1028, 1030
Exhibiting: Cathode-ray oscilloscopes; auxiliary instruments and accessories.

Telechron Dept., General Electric Co., Ashland, Mass. 541
Exhibiting: Synchronous timing motors; instrument movements; timers; electric clocks.

Telecomputing Corp., Burbank, Calif. 1102, 1104
Exhibiting: Universal and contact Telereaders; Telecordex; Telereadex; theodolite film reader.

Tenney Engineering, Inc., Union, N. J. 141
Exhibiting: New Products Instrument calibration baths. **Regular Products** Temperature humidity cycling chambers.
See ad on page **1255**. Circle **100** on inquiry card.

Tesa S. A., Renens Vd Switzerland 335
Exhibiting: New Products Micrometer calipers; precision cutter diameter micrometer; large inner and outer dimension gages; internal micrometer for gunbarrels. **Regular Products** Vernier calipers; micrometers; dial indicators and comparators; height gages; sidemilling cutters; center punches with magnifiers; micrometer calipers.

Thermal Harness Co., Meriden, Conn. 1818
Exhibiting: New Products Electrical hook-up harness; fire detection and turbine jet tailpipe thermocouples. **Regular Products** Thermocouples; thermocouple connectors, harnesses, and leads; adapters; firewall connectors; resistors.

Thermco Laboratories, Michigan City, Ind. 1040
Exhibiting: New Products Argon analyzer for welding-grade argon; atmosphere controller for chemical hoods and heat-treating processes; air-fuel ratio indicator. **Regulator Products** Flue-gas analyzer.

Thermo Electric Co., Saddle River Twp., N. J. 750, 752
Exhibiting: New Products Alarm system for monitoring temperatures up to several hundred points; recorder controller, on-off and pulse proportional control; self-balancing temperature indicators. **Regular Products** Thermocouples, wires and accessories; temperature controllers; quick-coupling connectors and panels.
See ad on page **1266**. Circle **113** on inquiry card.

Arthur H. Thomas Co., Philadelphia 5, Pa. 1001
Exhibiting: New Products Micro chemical apparatus; automatic recording spectrophotometer; automatic titrator; magnetic stirring apparatus; high-temp. vacuum oven. **Regular Products** Laboratory apparatus and reagents.

How's your technical library? Check this list.

Scientific and Industrial Glass Blowing and Laboratory Techniques by W. E. Barr and Victor J. Anhorn, 1949, cloth, 4½" x 8", 388 pages. Price $6.00 ☐

The Electronic Control Handbook by R. R. Batcher & Wm. Moulic, 1952, paper, 244 pages. Price $3.00 ☐

Heat Inertia Problems of Automatic Control of Temperature by Victor Broida, 1950, paper, 5¼" x 8¼", 61 pages. Price $1.00 ☐

Applications of Industrial pH Controls by Allen L. Chaplin, 1950, cloth, 4½" x 8", 144 pages. Price $2.50 ☐

Maintenance and Servicing of Electrical Instruments by James Spencer, Third Edition 1951, cloth, 4¾" x 8¼", 256 pages. Price $3.00 ☐

Mechanical Measurements by Electrical Methods by Howard C. Roberts, Second Edition 1951, cloth, 4¾" x 8¼", 357 pages. Price $4.00 ☐

Operation and Care of Circular-scale Instruments by James Spencer, 1949, cloth, 4½" x 8", 90 pages. Price $1.50 ☐

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Exhibiting: New Products Instrument for evaluating "handle" in textiles and paper; mechanical cotton fibre blender; impact-fatigue tester for paper and bag manufacture. **Regular Products** Tensile strength tester; Inkometer; tearing testers; softness-stiffness tester; sample cutter; curl size tester; vapometers; vapor transmission caps; potentiometer checking and calibrating set; temperature recorder; resistance bulb; bolometer.

T.O.B.I. N.V. Technisch Ontwikkelings Bureau Voor Instrumentatie Amsterdam, Netherlands 551
Exhibiting: New Products Prototype model miniature multipoint electronic recorder; hand viscosimeter. **Regular Products** Custom-built instruments and apparatus.

Tracerlab, Inc., Boston 10, Mass. 1106
Exhibiting: Robot scaling equipment; high-speed automatic scaler; scintillation counter; laboratory monitor; survey and rate meters; G-M tubes.

Trimount Instrument Co., Chicago 12, Ill. 824
Exhibiting: Well-type manometers; absolute-pressure, V-tube, multiple-tube manometers; indicating flowmeters; orifice flanges, plates; liquid-level gages; electronic level gages.
See ad on page **1210**. Circle **48** on inquiry card.

Trinity Equipment Corp., Roselle Park, N. J. 637
Exhibiting: New Products Sight-flow indicators; double-bore wells; welded thermocouples. **Regular Products** Thermowells; thermometer test wells; protecting tubes; skin-type, thermocouple assemblies; hydrogen probes.
See ad on page **1288**. Circle **145** on inquiry card.

Uehling Instrument Co., Paterson 3, N. J. 916
Exhibiting: New Products Flow-rate and purge-line meter. **Regular Products** Liquid-level indicators; vacuum, pressure, pressure and vacuum indicators; barometers; draft gauges; manometers; vacuum, and absolute pressure recorders.
See ad on page **1254**. Circle **99** on inquiry card.

Unicam Instrument Ltd., Cambridge, England 1109
Exhibiting: New Products Absorption spectrophotometers for visible, ultraviolet and near-infrared regions; high-temperature powder camera for x-ray analysis. **Regular Products** Goniometers; powder camera; rotation x-ray instrument.

Unistrut Products Co., Chicago 7, Ill. 1131, 1133
Exhibiting: New Products Adjustable meter framing system. **Regular Products** All-purpose metal framing.

U. S.-Burke Machine Tool Div., Cincinnati Mfg. Corp., Cincinnati, Ohio 1608

U. S. Electrical Motors, Inc., Los Angeles 54, Calif. 209, 211
Exhibiting: New Products Automatic motor control; general purpose, horizontal motors. **Regular Products** Variable-speed motors; internally geared motors (helical); horizontal motors; right angle, worm gear motors.

United States Gauge Division of American Machine and Metals, Inc., Sellersville, Pa. 756, 758, 760, 762
Exhibiting: New Products Pilot controllers; gages featuring rotary movements; receiving gages. **Regular Products** Gages and instruments.
See ad on page **1147**. Circle **26** on inquiry card.

Vacuum-Electronic Engineering Co., New Hyde Park, N. Y. 1108
Exhibiting: New Products Vacuum process laboratory unit. **Regular Products** Vacuum valves and gages; mass spectrometer; helium leak detector.

VEECO . . . The foremost manufacturer of automatic leak testing equipment . . .

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86-S Denton Ave., New Hyde Park, L. I., N. Y.

For more information circle **310** on inquiry card.

Vapor Recovery Systems Co., Compton, Calif. 757, 759, 761
Exhibiting: New Products Pulse code telemetering and supervisory control equipment. **Regular Products** Electronic remote gaging system; automatic tank gages; tank venting equipment; tank fittings.
See ad on page **1341**. Circle **181** on inquiry card.

Varian Associates, Palo Alto, Calif. 1016
Exhibiting: High resolution (nuclear magnetic resonance) spectrometer; laboratory magnet system.

Veeder-Root, Inc., Hartford 2, Conn. 802, 804
Exhibiting: New Products Multiple reset counter. **Regular Products** Counting devices.
See ad on page **1168**. Circle **43** on inquiry card.

Vibro-Ceramics Corp., Metuchen, N. J. 1505
Exhibiting: New Products Ultrasonic attenuation analyzer; ultrasonic intensity probe for corrosive liquids. **Regular Products** Ultrasonic generators and projectors, probes and attenuation analyzers; medical electrochemical instruments.

Booth No.

Viking Instruments, Inc., East Haddam, Conn. 708
Exhibiting: New Products—Porosity detectors for dielectric sheet materials; H_2S detectors; thickness gages; pneumatic-hydraulic servo systems. **Regular Products**—Pressure and temperature controls; electronic scanning systems; indicating and alarm systems.

Wallace & Tiernan, Inc., Belleville 9, N. J. 910, 912, 914
Exhibiting: New Products—Massometer and pneumatic scale feeder for continuously weighing flowable solids. **Regular Products**—Low-pressure and absolute pressure gages; manometers; barometers and pressure controllers; feeders and continuous weighers.
See ad on page **1165**. Circle **40** on inquiry card.

Wandel and Goltermann, Rentlingen, Germany (See Federal Telephone and Radio Company, Booths 202-204)

Ward Leonard Electric Co., Mount Vernon, N. Y. 1157
Exhibiting: New Products—300-watt 6-in. ring rheostat with twin shoe contacts. **Regular Products**—Power, and ring-type rheostats; magnetic relays; motor controls; dimmers; chrome plater.

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Waterman Products Co. Inc., Philadelphia 25, Pa. 1006
Exhibiting: Pocketscopes; pulsescopes. rakscopes; rayonic cathode-ray tubes.

Waxon-Carboff, Inc., Rochester 14, N. Y. 915
Exhibiting: Wax process recording chart paper.

Weatherhead Co., Cleveland 8, Ohio 501, 503
Exhibiting: Brass tube and pipe fittings; cocks; reusable hose couplings, industrial hose; flareless fittings.

Webber Mfg. Co., Inc., Indianapolis 3, Ind. 411, 413
Exhibiting: New Products—Low-, high-temp. bench-types temperature tester. **Regular Products**—Environmental testing equipment for temperature, humidity and altitude.

W. M. Welch Mfg. Co., Chicago 10, Ill. 743, 745
Exhibiting: New Products—Recording paper densitometer for chromatography and electrophoresis. **Regular Products**—Vacuum pumps; transmission and reflection densitometers; laboratory scales; electrical measuring instruments; barometers; resistance boxes; rheostats.

W. M. Welch Mfg. Co., Chicago 10, Ill. 1125
Exhibiting: New Products—Densichron densitometer; cloud chamber; film loops; lectern stop clock; stainless cathetometer; Chart of radiant energies. **Regular Products**—Electrical instruments; dial resistance boxes; laboratory balances; vacuum pumps; air-flow rheostats.

West Instrument Corp., Chicago 22, Ill. 1035, 1037
Exhibiting: New Products—All-electronic temperature recorder, uses no vacuum tubes. **Regular Products**—Temperature controllers, indicators, thermocouples, lead wire, accessories.
See ad on page **1287**. Circle **143** on inquiry card.

Weston Electrical Instrument Corp., Newark 5, N. J. 846, 848
Exhibiting: New Products—Miniature electrical recorder; TV test equipment; core magnet mechanism instruments; self-balancing indicator; fluxmeter; sensitizing amplifier; d-c. amplifier. **Regular Products**—Test equipment; accessories, relays and control instruments; tachometers; thermometers; aircraft instruments; light measuring equipment; recorders and controllers; moisture meters; d-c. amplifiers; photoelectric cells.
See ad on page **1158**. Circle **34** on inquiry card.

Wheelco Instruments Div., Barber-Colman Co., Rockford, Ill.
453, 455
Exhibiting: New Products—Direct-deflection-type automatic controller; Limitrol plus combustion safeguards and recording-controlling slide wire. **Regular Products**—Recording and controlling instruments for industry.
See ad on pages **1176**, **1265**. Circle **209**, **112** on inquiry card.

John C. Whiddett Co., Bala Cynwyd, Pa. 1139
Exhibiting: New Products—Packaged and custom-built control systems. **Regular Products**—Solenoid valves; temperature, pressure, level controls; Diaphragm valves; pre-set counters; timers; photoelectric controls; optical pyrometers.

S. S. White Dental Mfg. Co., Industrial Div., New York 16, N. Y.
137
Exhibiting: New Products—Industrial airbrasive unit. **Regular Products**—Flexible shaft and casing; aircraft accessories; molded resistors; valves; molded plastics.

Wiancko Engineering Co., Pasadena, Calif. 360, 362
Exhibiting: New Products—Instrumentation and components for digitizing pressures, forces, position, etc.; digital ballistics analyzer; miniature airborne carrier system. **Regular Products**—Pressure, force, acceleration and position pickups; carrier equipment; packaged instrumentation systems.
See ad on page **1292**. Circle **153** on inquiry card.

Yarnall-Waring Co., Philadelphia 18, Pa. 219
Exhibiting: New Products—Electronic secondary liquid-level indicator, duplicates primary at remote locations. **Regular Products**—Impulse steam traps; liquid-level indicators, recorders, remote alarm signals.

N. Zivy & Co., Ltd., Basle, Switzerland 214, 216
Exhibiting: New Products—Predetermining counter; counter for self-service liquid distributors. **Regular Products**—Counters: rotary, ratchet, yardage, predetermining, hand-tally, clutch, Speedometers.

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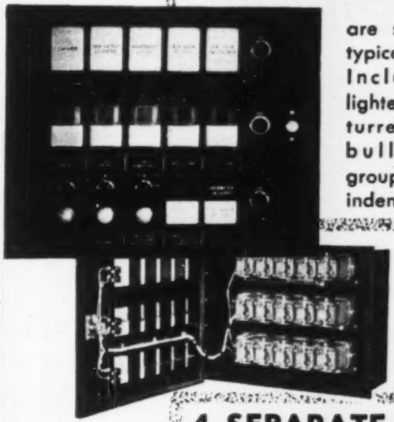

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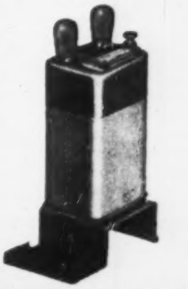
is a marvel of efficiency for alarm signal service. Over 100 variations in Circuit Sequences are possible in one uniform plug-in unit.



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The Month's NEW INSTRUMENTS

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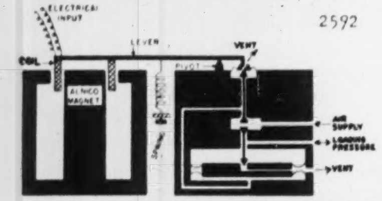
FOR FURTHER INFORMATION USE THE POSTAGE-FREE ORDER CARD ON PAGE 1347

PROCESS CONTROL

Electropneumatic Control-system Power Relay

New "Autronic Type P2R Power Relay" eliminates transmission lags common to pneumatic systems, is designed to operate with maker's "Autronic" control system; takes electrical output from controller or manual control and converts it to an air-loading pressure proportional to electric current. Maker states that since unit contains no vacuum tubes, maintenance is minimized and consists mainly of occasional cleaning of pneumatic pilot and booster relay.—*The Swartwout Co., 18511 Euclid Ave., Cleveland 12, Ohio.*



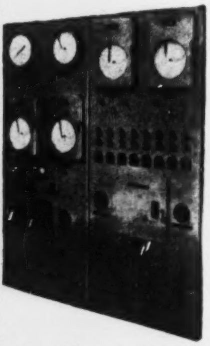
For more information circle **401** on inquiry card.

Rack-mounted Controllers

New relay-rack-mounted "Simplytrol" on-off type automatic controllers are mounted on standard 19-3/16 in. by 6-¾ in. panels; are interchangeable with many other types of controls. Each is provided with a quick-disconnect plug for easy service or replacement.—*Assembly Products, Inc., P. O. Box 191, Chagrin Falls, Ohio.*

For more information circle **402** on inquiry card.

Central Filter Control



New "Auto Central Filter Control" provides semi-automatic sequence operation for back-washing rapid sand water filters. It signals need for filter backwashing in accordance with loss-of-head conditions. Backwash cycle is then initiated and carried out, and filters returned to operation automatically. Operation can be changed to manual when desired. System is applicable to all types of rapid filter installations.—*Builders-Providence, Inc., 345 Harris Ave., Providense 1, R. I.*

For more information circle **403** on inquiry card.

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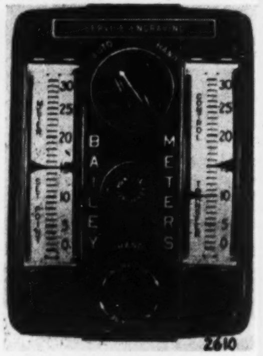
Photoelectric Components 1280
Electromechanical Components 1281
Mechanical Components 1285
Valves 1286
Educational, etc. ..1288
For Aircraft 1289
Miscellaneous 1290
Computing 1292

Control Station

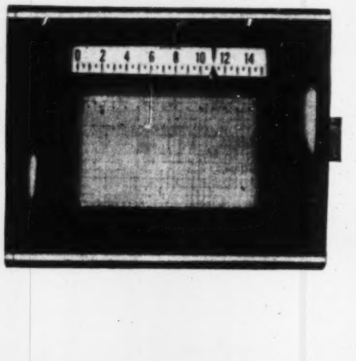
New "Mini-Line Control Station" provides a complete picture of pneumatic control-system performance. Operator has choice of remote manual control independent of all automatic controllers for starting and stopping the process and for periods where measuring and/or controlling elements may be out of service. Side vertical gages indicate signals from transmitter, set point or bias, hand control, and automatic control. Three control knobs are for automatic-hand selection, set point or bias adjustment, and hand control.—*Bailey Meter Co., 1050 Ivanhoe Rd, Cleveland 10, Ohio.*



For more information circle **404** on inquiry card.

Continuously-standardized Recording Potentiometer

New "No-Batt" continuous standardization device is available on round-chart and strip-chart models of "Electronic Dynamaster Potentiometer." A constant-voltage source continuously standardizes instrument and eliminates dry cells. Device employs a voltage regulator but retains standard cell, thus assuring accuracy. Method consists of regulating output of a dry-disk rectifier to reasonable limits, and floating a standard cell across the load to minimize deviations of load value from required value.—*The Bristol Company, Waterbury 20, Conn.*



For more information circle **405** on inquiry card.

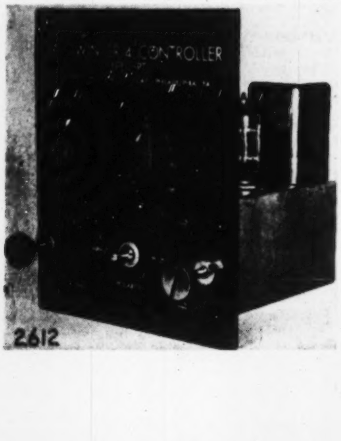
Infrared Analyzer

New Infrared Analyzer, multi-stream plant type, employs an optical system of double-beam, filter photometer type using non-selective detectors; is fully automatic; can be used to cyclically monitor as many as five process streams for a single component or group of components. Alternately, it can utilize continuous single-stream analysis for direct process control. Periodic automatic standardization compensates for ambient-temperature and barometric fluctuations. Output can be telemetered. Sampling system design and components can be supplied. Housings are explosion-proof.—*Instrument Sales Div., Phillips Petroleum Co., Bartlesville, Okla.*

For more information circle **406** on inquiry card.

Automatic Controller for Force-type Pickups

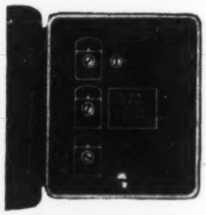
New "PTL Controller," for on-off or high-low control action in response to force, weight, pressure or torque



AUTRONIC TEMPERATURE TRANSMITTERS—Two types available: (1) T2C thermocouple converter for use with thermocouples. Bulletin A-712. (2) T2E resistance thermometer with T2A thermometer adapter including interchangeable range card. Bulletin A-706.

AUTRONIC PRESSURE TRANSMITTER — P2T pressure primary element for up to 5000 psi eliminates transmission lags. No friction, extremely low hysteresis. All-electric signal transmission. Bulletin A-708.

AUTRONIC ADAPTER UNITS — Swartwout makes several adapter units to utilize any a-c or d-c signal, such as strain gauges, pH, oxygen, etc., for use with the controller, recorder, or other Autronic components.



AUTRONIC CONTROLLER — Heart of the Autronic System. Instantaneous, all-electronic response. Proportional, automatic reset, and/or rate action adjustment ranges; with or without set-point. Bulletin A-702.

Swartwout

AUTRONIC COMPONENTS

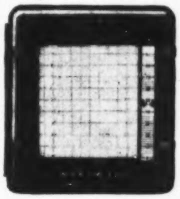
are the answer when rapid, precise control is the problem

Temperature . . . pressure . . . flow . . . pH . . . variable speed and many other control requirements. If it can be done by electro-mechanical or pneumatic means, it can be performed better, faster, easier, and generally at lower cost with Swartwout Autronic systems or components. Some are illustrated below. So if control and/or recording is your problem, call your Swartwout representative for a consultation at your convenience.

A-9851

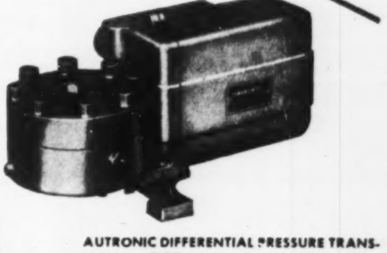
AUTRONIC FINAL ELEMENTS — P2R power relay (above), an electro-pneumatic transducer, takes d-c control signal and converts it to proportional air loading pressure. Bulletin A-710A. Other electrical final elements supplied for variable speed motor control, magnetic amplifier, etc.

AUTRONIC INDICATOR — Rapid, accurate, miniature plug-in type instrument interchangeable with recorder. Supplied with or without set-point adjustment.



AUTRONIC RECORDER — Miniature plug-in type null-balance instrument gives true linear trace on 31-day strip chart. With or without set-point adjustment. Bulletin A-704.

AUTRONIC MANUAL CONTROL — Operates independently of recorder and controller. Continuous indication of valve position. Simplified switchover means bumpless transfer. Bulletin A-705.



AUTRONIC DIFFERENTIAL PRESSURE TRANSMITTER—D2T transmitter with unique diaphragm pressure seal that eliminates bellows and torque tubes for extreme sensitivity at static pressures as high as 5000 psi. All-electric, no vacuum tubes. Bulletin A-707A.

Swartwout *Autronic* CONTROL SYSTEM

THE SWARTWOUT COMPANY • 18511 EUCLID AVENUE • CLEVELAND 12 • OHIO

For more information circle **46** on inquiry card.

measured by means of "SR-4" cells and torque pickups, is operated in conjunction with "PTL Amplifier." Two controllers may be used with a single amplifier; example, high and low level alarms or adjustable band width to operate a throttling valve. S-p.d-t. relay can be adjusted by knob to trip anywhere over 0-100 percent of full scale. Standard unit is for panel mounting but a case is available.—*Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.*

For more information circle **407** on inquiry card.

Mass Spectrometer

New "Model 21-103C Mass Spectrometer," refinement of former designs in maker's mass spectrometer series; analyzes hydrocarbon waxes and other compounds in high-mass ranges previously almost impossible to analyze; doubles range of complete resolution between adjacent peaks by increasing readings to mass 350. Optional collection systems: a 30-mil slit with a metastable ion suppressor, or dual slit arrangement (30- and 7-mil) without ion suppressor. Another available new fixture is heated inlet system enabling introduction and analysis of chemicals with vapor pressures too low to be analyzed at room temperatures.—*Consolidated Engineering Corp., Pasadena 8, Calif.*

Analyzer Tube Assembly

2627

For more information circle **408** on inquiry card.

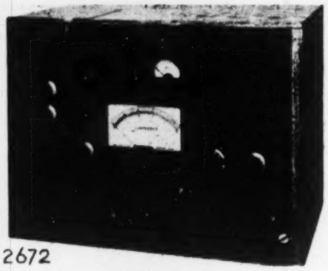
Chart Paper and Ink

New chart paper and recording inks are said to provide greater accuracy, faster recording speeds and broader applications of recording. Chart paper is claimed to provide "up to 100 percent greater accuracy" in recording data: minimization of hygroscopic expansion and contraction. It is sized so that new inks will not "feather." New inks carry dye into paper but not deeply enough to start "feathering" or to break through fibers.—*Industrial Div., Minneapolis-Honeywell Regulator Co., Philadelphia 44, Pa.*

For more information circle **409** on inquiry card.

Color Controller

New "Trichrometer," for control of any process in which color is a factor, measures color in terms of dominant wavelength, saturation and brightness, and maintain these three qualities within preset tolerances for any continuous process. Provision is made for instantaneous comparison with Standard ICI coordinates, also for rechanneling, dumping, and marking and sounding alarms. Product may be luminous, transmitting, reflecting or fluorescent.—*Kaye Development Co., 79 Prospect St., Stamford, Conn.*



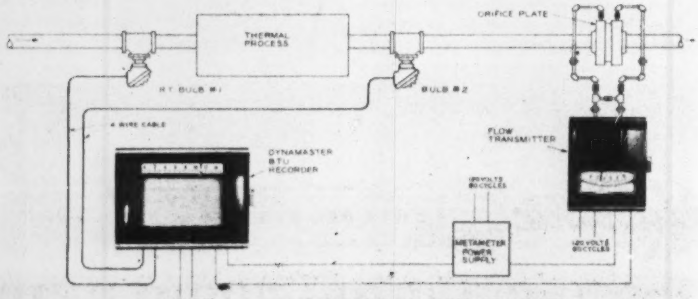
2672

For more information circle **410** on inquiry card.

Btu. Recorder-controller

New "Dynamaster" Btu. recorder-controller systems provide continuous measurement and control of rate-of-heat input or output; record heat supplied to or drawn from process vessels, etc., and regulate temperature or flow-rate of heat-transfer medium. Basic system is illustrated; other systems provide for recording temperature difference along with Btu.; recording Btu. and either flow-rate or temperature difference; totalizers (optional) to integrate energy or heat-transfer; etc.—*The Bristol Company, Waterbury 20, Conn.*

For more information circle **411** on inquiry card.



THE BASIC DYNAMASTER BTU SYSTEM

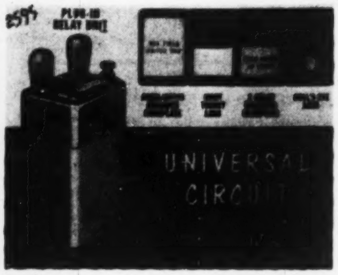
Dissolved-oxygen Analyzer

New amperometric-type dissolved-oxygen analyzer operates as simply as a modern pH meter; employs a rotating platinum electrode and automatically translates diffusion-current into units of dissolved-oxygen concentration. Range 0-10 ppm. Accuracy better than 5 percent of true value for most aqueous solutions. Unlike conventional Winkler test, new instrument is not subject to interference by dissolved Fe, Ca, Mg, sulfides, nitnites, or organic matter. Samples can be colored or turbid.—*Dorber Co., 7741 W. Palatine Ave., Chicago 31, Ill.*

For more information circle **412** on inquiry card.

Alarm-system Plug-in Unit

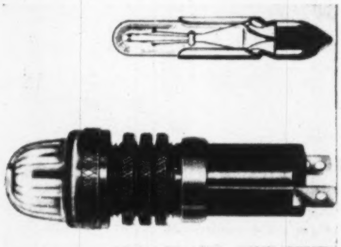
New "Universal Tel-Alarm UN-100 Series Circuits" make it possible to use one type of plug-in unit for over 100 signalling sequence operations. Unitized relay assembly accommodates either N-O or N-C field trouble contacts; may be easily changed in the field for either maintained or momentary service. All variations in operating sequences from N-O to N-C, or to add lock-in features, are accomplished by simple changes in terminal block connections or jumpers.—*Tigerman Engineering Co., 4332 N. Western Ave., Chicago 18, Ill.*



For more information circle **413** on inquiry card.

Pilot-light Assemblies

New series of "Dialco" pilot light assemblies are designed to employ slide-base telephone type incandescent bulbs, facilitating lamp replacement. Wide choice of screw and friction fitted caps with flat and convex lenses of ⅜-in. and ½-in. diam. Soldering terminals or binding screws.—*Dialight Corp., 60 Stewart Ave., Brooklyn 37, N. Y.*

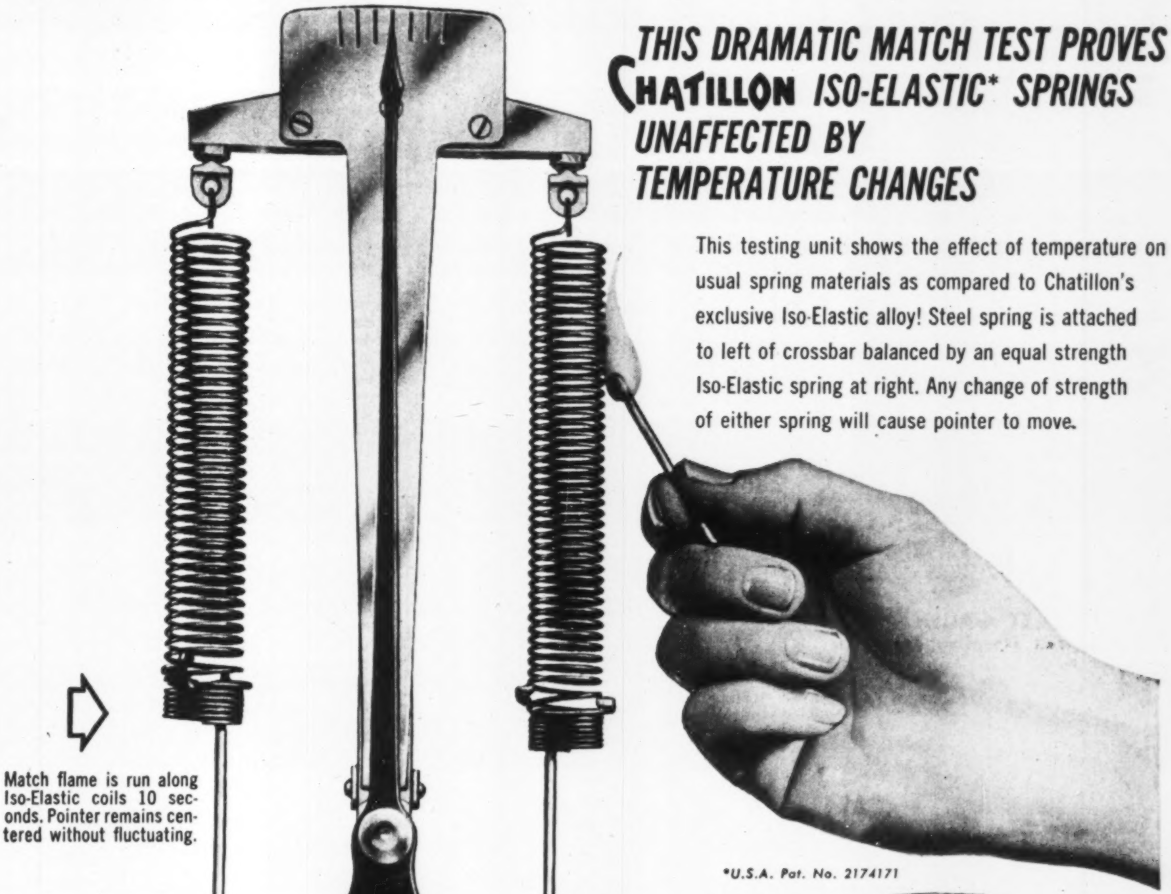


For more information circle **414** on inquiry card.

Explosion-proof Controllers

New explosion-proof units, added to maker's line of electrolytic conductivity equipment, are cased in cast steel

CHATILLON guarantees to improve your product!



THIS DRAMATIC MATCH TEST PROVES CHATILLON ISO-ELASTIC SPRINGS UNAFFECTED BY TEMPERATURE CHANGES*

This testing unit shows the effect of temperature on usual spring materials as compared to Chatillon's exclusive Iso-Elastic alloy! Steel spring is attached to left of crossbar balanced by an equal strength Iso-Elastic spring at right. Any change of strength of either spring will cause pointer to move.

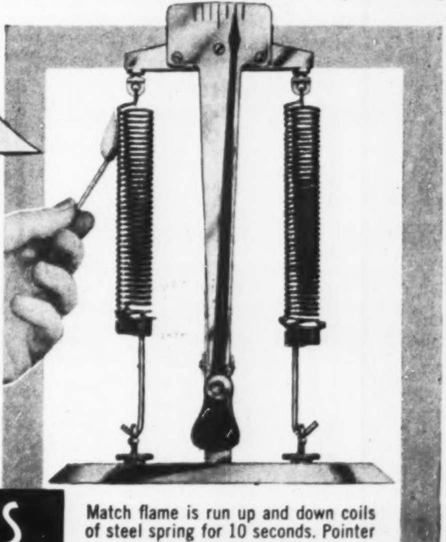
Match flame is run along Iso-Elastic coils 10 seconds. Pointer remains centered without fluctuating.

*U.S.A. Pat. No. 2174171

When ordinary spring materials are subjected to either an increase or decrease in temperature, the modulus of elasticity either increases or decreases, thereby changing the strength of the spring.

Chatillon Iso-Elastic, however, has a constant thermal coefficient of the modulus of elasticity and springs made from this revolutionary alloy maintain constant strength throughout temperature ranges from —150°F to +150°F.

Have a Chatillon engineer demonstrate this remarkable test for you without obligation. Iso-Elastic can improve the accuracy of your spring activated instruments. Engineering bulletins available upon request.



Match flame is run up and down coils of steel spring for 10 seconds. Pointer moves away from zero reading.

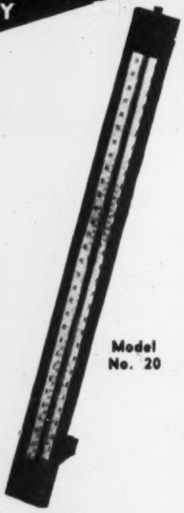
JOHN CHATILLON & SONS

85 Cliff Street, New York, N. Y.

Manufacturer of Precision Springs and Measuring Apparatus Since 1835

For more information circle **47** on inquiry card.

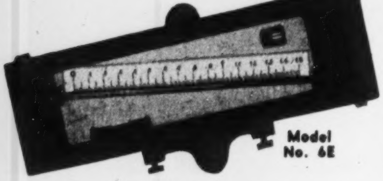
Trimount
MANOMETERS
- EASY READING
- ACCURATE
- STURDY


Model No. 20

WELL TYPE MANOMETERS

- Welded steel channel
- Enclosed plate glass cover
- Red Line Pyrex tube
- Front Zero adjustment

DRAFT GAUGES
with Wall Mounting Brackets


Model No. 6E

- Dust tight glass cover
- Adjustable scale
- Pyrex tube—compression gland packed

SLIDING SCALE U-TUBE MANOMETERS

- Cast aluminum channel
- Heavy Pyrex U tubes
- Leak proof compression type glands

Model No. 4

Write for latest bulletin E showing our complete line of Manometers. Contact us for custom made designs to help you solve your problems.

Visit our Booth 824 at the Instruments Show in Philadelphia Sept. 13-24.

Trimount
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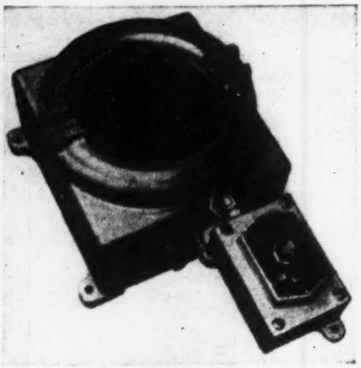
For more information circle **48** on inquiry card.

NEW INSTRUMENTS



housings with standard approved conduit fittings. Glass panel permits viewing. Built-in motor allows setting from a remote explosion-proof switch.—*Industrial Instruments, Inc.*, 89 *Commerce Road, Cedar Grove, N. J.*

For more information circle **415** on inquiry card.

TEMPERATURE

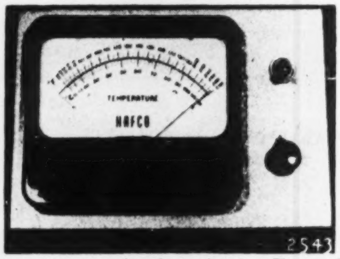
Miniature Thermocouple

New "1-CH-CO-2" has response of less than ¼ sec.; enables measuring fast temperature changes; is of size suitable for mounting close to heat-generating components and its transistor type base provides ease of mounting and polarity indication. Thermoelements are 0.001 in. diam.; ceramic support tube is 1/16 in. diam. by 1-⅞ in. long; base is ⅜x5/16x3/16 in.—*Vacuum Tube Products*, 506 *S. Cleveland St., Oceanside, Calif.*

For more information circle **416** on inquiry card.

Thermistor Thermometers

New "Thermindicators" utilize thermistor primary elements; are available with one thermistor and 6-ft. lead, or with a junction box and from two to six thermistors. Two-cell flashlight battery has life of one year or more. Photo shows "No. TH-250" graduated 30-250 F. and 0-120 C. A short-range model, "No. TH-125," has 25-125 F. scale with half-degree precision.—*Hafco Scientific Instrument & Development Co., Box* 699, *Westfield, N. J.*



For more information circle **417** on inquiry card.

Traveling Thermometer

New recording thermometer, designed to pass through a traveling oven with bread and other baked goods, is no higher than a loaf of bread when in its operating position. For use, it is laid on its back next to a pan of baked goods, and allowed to pass completely through traveling oven. When it emerges at discharge end, it yields a record of temperatures encountered at each point along the way. It can be used also in non-food baking applications where a low-clearance instrument is required.—*The Bristol Company, Waterbury, Conn.*

For more information circle **418** on inquiry card.

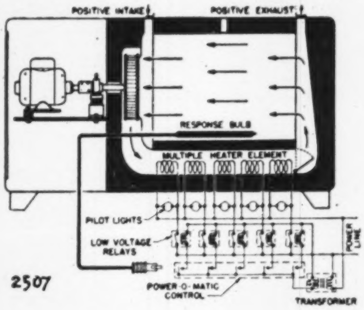
Portable Potentiometer

New "Model 9-A Pyrotest" is said to have "five times the range of current temperature measuring instruments and increased accuracy." Accuracy is 1/6 of 1 percent of spans; sensitivity is 10 microvolts; resolution exceeds 2000 increments. Designed for checking and calibrating all types of temperature instruments, instrument is powered by Mallory mercury "A" batteries, has removable cover and leather handle. It may be used also to measure temperatures electrically or to measure d-c. potentials up to 53 mv. Special scales can be supplied.—*Technique Associates*, 2047 *N. Parker Ave., Indianapolis* 18, *Ind.*

For more information circle **419** on inquiry card.

Fully Controlled Ovens

New "Power-O-Matic Control" is feature of new "Con-Wate" mechanical convection ovens. It is said to save 23.8 percent on kw-hr. input and control temperature to 0.5 C. by fully automatic wattage control in relation to operating temperature and work load. Over- and under-shooting are eliminated and "straight-line" control is obtained because, after operating temperature is reached, wattage input is always minimal instead of on-and-off. Recovery time is always minimal because opening of door(s) immediately energizes 100-percent "Modella" heater elements.—*Blue M Electric Co.*, 306 *W. 69th St., Chicago* 21, *Ill.*

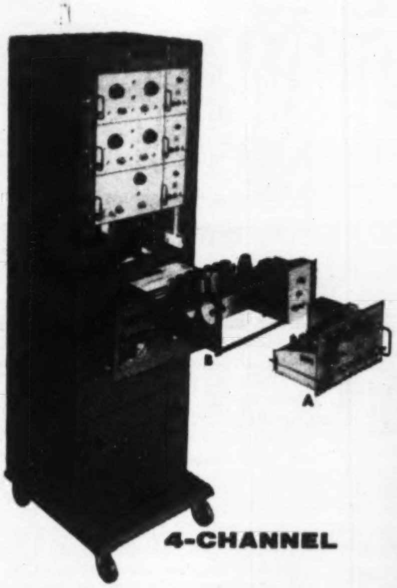


For more information circle **420** on inquiry card.

Temperature Controller

New "Truetemp Input Controller" is to be added to an existing industrial on-off temperature control system (thermocouple-actuated) to maintain heating temperatures as close as 0.2 F.: control point is dynamically shifted in direction and magnitude so as to counteract effects of thermal inertia. Under- or over-shooting is thereby eliminated in such applications as heat treating, injection molding, kilns, laboratory furnaces, etc. "Truetemp" is said to be particularly useful with "difficult" plastics such as nylon and teflon. Two models: "1700-115" for 115 v.ac. (17 amp.) and 1700-230" for

fits your oscillographic recording need?



4-CHANNEL

As a graphic example of the design idea that has brought new versatility to industrial recording, a Carrier Preamplifier (A) is shown above in position to plug into a Driver Amplifier in framework with Power Supply (B) which are normally already in place in the Basic Cabinet Assembly.

The identical design principles of the four-channel system are provided in the two-channel, the only difference being the number of channels.

Sanborn "150" Recording Systems that put to use the original design concept of amplifier interchangeability (illustrated at the left) start with either a four-channel or two-channel standard Basic Assembly, to which the user adds whatever selection or combination of preamplifiers (A) are needed for his recording problem. The standard Basic Assemblies comprise a metal Cabinet, Recorder, and a built-in Driver Amplifier and Power Supply (B) for EACH channel. Presently available Preamplifiers are: AC-DC, Carrier, DC Coupling, Servo Monitor, Log-Audio, and Low Level Chopper.

Advantages common to ALL Sanborn Recorders are: inkless recording (by heated stylus) on plastic coated strip chart paper, and in true rectangular coordinates . . . high torque galvanometer movement . . . time and code markers . . . numerous paper travel speeds.

2-CHANNEL

"150"

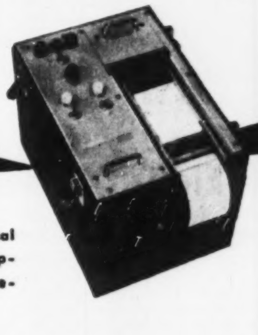
COMPLETE FOUR-CHANNEL SYSTEM FOR USE WITH ANALOG COMPUTERS

This "150" system consists of a Cabinet Assembly, a four-channel Recorder, and *two* dual channel DC Amplifiers. Each amplifier is complete with a common power supply. Each measures and records two separate single-ended signals, at sensitivities between one and one hundred volts per centimeter. The *two*-channel version of this system will comprise Cabinet, *two*-channel Recorder, and *one* dual channel amplifier.

"150"

SINGLE-CHANNEL RECORDER

A compact, lightweight unit for use when only one channel is required — provides permanent, inkless recording in *true* rectangular co-ordinates; *five* paper speeds (5, 10, 25, 50, 100 mm/sec.); *extra* stylus for either manual or remote timing and coding marks. Designed for simple, patch cord connection to *any* of the several "150" preamplifiers (plus driver amplifier and power supply), available soon in portable metal cases.



Catalog and technical data on all "150" equipment available on request.

Ask, also, for a copy of the *Right Angle* — a Sanborn publication devoted to oscillographic recording in industry.

SANBORN COMPANY
Industrial Division
CAMBRIDGE 39, MASS.

For more information circle 49 on inquiry card.

The pause that Sequences...
NAVY
TARRYTRON
TIME DELAY
DIAPHLEX

When a measured delay is required in sequencing an electronic control system, Tarrytron thermal time delay offers a practical and economical solution.

Qualified to MIL-R-6106 by Inland Testing Laboratories and thoroughly flight tested by practically everything that flies, Tarrytron provides a reliable, small, light weight, hermetically sealed timer.

It weighs 4½ ounces and measures 2¹⁄₁₆" x 1⅝" x 1¹³⁄₃₂" displacing only 4.75 cubic inches. Time Delay Range settings range from ½ to 120 seconds and can be calibrated to 28 volts DC or 115 Volts AC.

We invite your inquiry.

Cook Electric Company

Established 1897
2700 Southport, Chicago 14, Illinois

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See us at Booth No. 840 at the Show

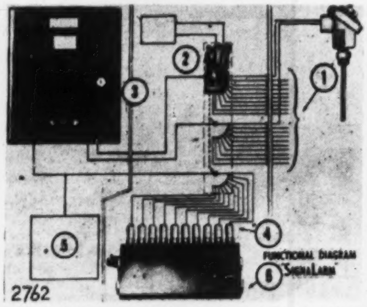
For more information circle **50** on inquiry card.

230 v.ac. (8.5 amp.). Auxiliary mercury relays available for higher relay load requirements.—*Winslow Co., 9 Liberty St., Newark 5, N. J.*

For more information circle **421** on inquiry card.

Temperature Monitoring System

New "SignaLarm" indicates, by means of red and green lamps and an audible alarm, temperatures at points scanned. Master measuring unit can be preset to signal at high or low point. Audible alarm can be silenced by pressing a button, but red light stays on until temperature returns to normal. Different systems can be built-up from standard units. Each "SignaLarm" can handle up to several hundred thermocouples or resistance bulbs.—*Thermo Electric Co., Inc., Saddle River Township, Rochelle Park P. O., N. J.*



2762

1. Thermocouples or resistance bulbs; 2. impulse timer and stepping switch; 3. master measuring unit; 4. memory relay; 5. audible alarm; 6. signal lamp.

For more information circle **422** on inquiry card.

Temperature Controller

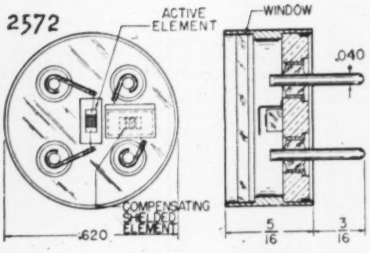
New "No. 1549 Temperature Control Valve" is pilot-operated; is a "tight-closing" type valve, designed for high-pressure service particularly in larger sizes. 5-in. and 6-in. sizes are double-seated; smaller sizes singled-seated. Operation: pilot valve is actuated by expansion of one-piece bellows-type primary element; pilot valve employs inlet pressure to operate main valve.—*Klipfel Valves, Inc., Hamilton, Ohio.*

For more information circle **423** on inquiry card.

Infrared Bolometers

New "Type BC-1" bolometers are extremely fast (milliseconds response); utilize thermistor elements blackened to absorb about 80 percent of infrared radiant flux. Assembly is suitable for industrial and military as well as laboratory applications (see drawing). Matched compensator minimizes ambient-temperature variations. Use of a compensating bridge minimizes noise. Standard windows: coated silver chloride or "KRS-5"; special windows on order. Six standard sizes, with thermistor areas from 0.5x0.5 to 0.5x4.0 mm. and response times from 2 to 8 milliseconds.—*Olympic Development Co., 30 Commerce Rd, Stamford, Conn.*

2572



For more information circle **424** on inquiry card.

Radiometer

New "Model IR-P2 Radiometer" for measurement of infrared radiation, and for remote measurement of temperature, employs a unique optical chopper whereby a thermistor infrared detector compares target radiation with radiation from an internal reference blackbody. Performance of instrument is only limited by Johnson noise of thermistor infrared detector. Internal-standard calibrating voltages allow quick calibration of system when desired.—*Olympic Development Co., 30 Commerce Rd., Stamford, Conn.*

For more information circle **425** on inquiry card.

Reference Blackbody

New "Type RS-1A and TC-2A Infrared Reference Source and Controller" comprises: (1) "RS-1A" secondary-standard blackbody (right) for 60-to-230 C. temperature range, suitable for field as well as laboratory calibration of infrared devices, featuring a 14-deg. conical cavity with wall emittance exceeding 80 percent

SMALL EYE FOR A BIG JOB...

the GPL PYE "STATICON"

the miniature camera tube for new advances in industrial TV

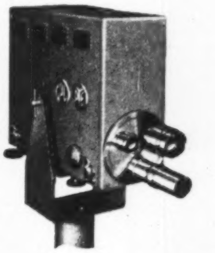
TYPE GP-6198

The Staticon *(Type GP-6198)* is a photoconductive tube, operating on the low velocity scanning principle. It is only 6½ inches long and 1 inch in diameter, yet has a resolution of 600 lines or better.

The sensitivity of the Staticon provides a clear sharp picture at *f*/2.0 with only 50 foot-lamberts in the scene.

Developed and refined specifically for high definition in small size, the Staticon permits major advances in compact, light-weight TV cameras for many uses. Initial cost and operating costs are lower.

Complete specifications of this tube are available from any General Precision Laboratory office. The tube will be offered to distributors throughout the U.S., as well as in complete camera chains by GPL PYE.



THE MODERN INDUSTRIAL CAMERA

This GPL PYE camera uses the new Staticon! It's high-definition TV for industry and science. All main elements in one case; uses standard TV receivers or monitors for viewing at any distance.

Staticon camera has simple controls, uses AC power, needs only normal lighting.

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For more information circle **51** on inquiry card.

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TRIMPOT*
1/2 ACTUAL SIZE

BOURNS instruments feature the finest design and workmanship in wire-wound potentiometry. Their precise electrical signals, requiring no amplification, are used in control systems, telemetering networks and recording circuits. Rugged construction guarantees accurate and dependable performance during the severe shock, vibration and acceleration conditions encountered in aircraft and industrial applications.

LINEAR MOTION

Physical variables such as linear displacement, acceleration and pressure are measured to an accuracy of 0.25% of instrument range. Single or dual potentiometers and linear or functional outputs are a few of the many characteristics that can be provided. Besides the hundreds of standard models and ranges available, special designs may be developed for individual requirements.

GAGE PRESSURE

BOURNS TRIMPOTS—the ultimate in subminiaturization—are used for circuit trimming in miniaturized assemblies subjected to extreme environmental conditions.

BOURNS many years of experience in specialized potentiometer instrumentation, plus modern production facilities, assure you of the highest quality instruments attainable.

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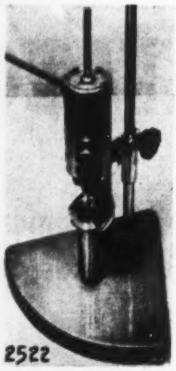
For more information circle 52 on inquiry card.

in 1-to-25-micron region, whence over 95 percent total hemispherical emittance of cavity. ★ (2) "TC-2A" temperature controller (left) is a 2-tube bridge type exactly suited to maintain desired temperature of blackbody.—*Olympic Development Co., 30 Commerce Rd, Stamford, Conn.*

For more information circle **426** on inquiry card.

LABORATORY

Torsional Viscometer

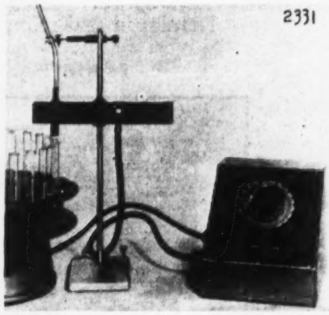

2522

New "Drage Viscometer" (designed at Dr. Epprecht's Chemical Institute, Switzerland) indicates viscosity changes instantly. Viscous drag is transmitted through rotating measuring element to rotatably-mounted motor whose torque is opposed by a precision constant-modulus hairspring. Pointer is attached to motor casing. Three speeds: 20, 64 and 200 rpm.; design is such that measurements are unaffected by friction in gearing. —*Drage Products, 406 32nd St., Union City, N. J.*

For more information circle **427** on inquiry card.

Drop Counter and Dispenser

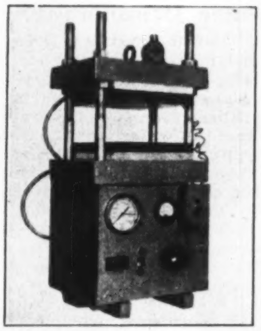
New drop counter comprises photocell connected to a timer; counts drops from 1 to 400 at each setting. Drops fall directly from glass tip into collecting tube without touching any part of counter assembly. Timer automatically indexes collector to next position after preset number of drops has been delivered into tube.—*Microchemical Specialties Co., 1834 University Ave., Berkeley 3, Calif.*


2331

For more information circle **428** on inquiry card.

Laboratory Press

New "Model 12-12" 30-ton laboratory press features flexibility of operation. Stroke 6 in.; maximum daylight opening 10 in.; longer columns can be supplied; platen area 144 sq. in. Unusual feature is paralleling of platens by precision boring of guide holes. Heating platens readily removed. Bimetallic type temperature regulator and relayed load method for close tem-



perature differential. Temperature indicator is thermoelectric type. Prompt delivery.—*Hydraulic Div., Wabash Metal Products Co., Wabash, Ind.*

For more information circle **429** on inquiry card.

Electrophoresis System

New "Spinco Model R Paper Electrophoresis System" comprises an automatic curve-drawing integrator, two 8-strip electrophoresis cells, and a constant-current/constant-voltage regulated power supply. Procedures and corresponding equipment have been integrated to routinize each step from application of accurately-metered samples to autographed final results.—*Specialized Instruments Corp., 655 O'Neill Ave., Belmont, Calif.*

For more information circle **430** on inquiry card.

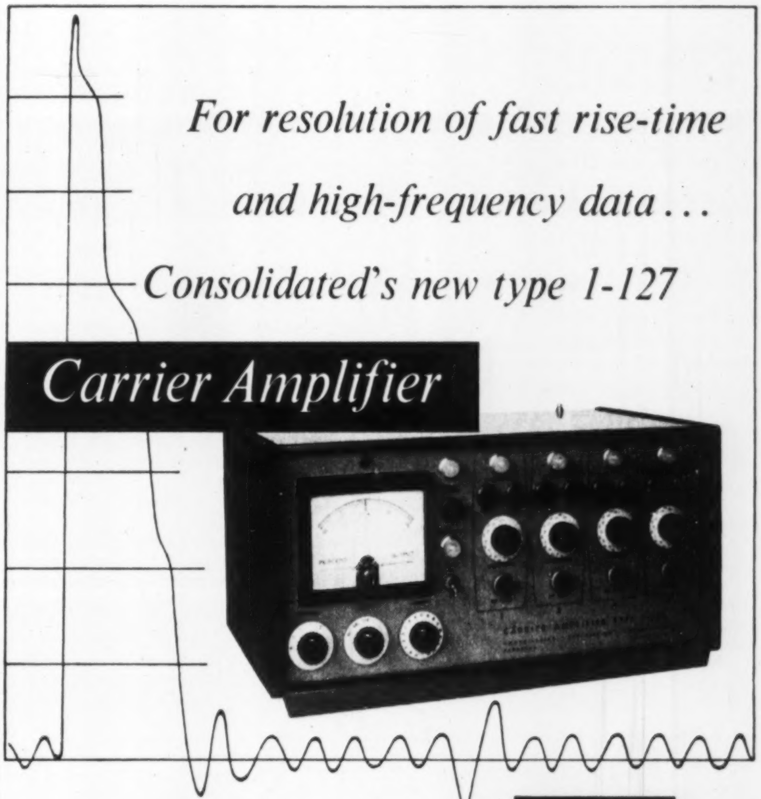
Electrophoresis Set

New "Electrograf" is said to open a new, simple and important avenue to the analyst for quantitative and qualitative study of materials exhibiting electromigrating characteristics. Migrating chamber is molded, one-piece transparent plastic, accommodating twenty ½-in. wide or twelve 1-in. wide filter strips, with voltage control from 0 to 450 volts, and current control from 0 to 50 ma. Power supply has sufficient capacity and is equipped with necessary plug-ins to operate four migrating chambers simultaneously.—*Labline, Inc., 217 N. Desplaines St., Chicago 6, Ill.*

For more information circle **431** on inquiry card.

X-ray Dosemeter

New "Baldwin Farmer Dosemeter," for continuous indication of integrated x-ray doses in radiological clinics, for health-physics x-ray monitor-



For resolution of fast rise-time

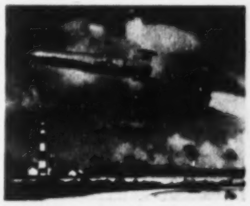
and high-frequency data . . .

Consolidated's new type 1-127

Carrier Amplifier

Excellent gain and zero stability together with remarkable linearity make Consolidated's new 20 kc Carrier Amplifier the most outstanding instrument ever offered for the measurement and recording of high-frequency transient data. Operating on the suppressed carrier principle, the 1-127 is designed for resistance or reluctance bridge-type transducers, and has sufficient output to drive the CEC 7-326 galvanometer to a full-scale trace deflection of plus or minus 1.5 inches throughout its full frequency range of 0 to 3000 cps.

Designed for stacking as well as rackmounting, this 4-channel precision instrument offers performance never before available. It may be operated with several hundred feet of input cable. Carrier voltage is continuously adjustable. Strain gage transducers from 60 to 1000 ohms are accommodated. Rugged construction and careful design permit operation under wide variation of ambient conditions. For full information, write for CEC Bulletin 1550-X1.



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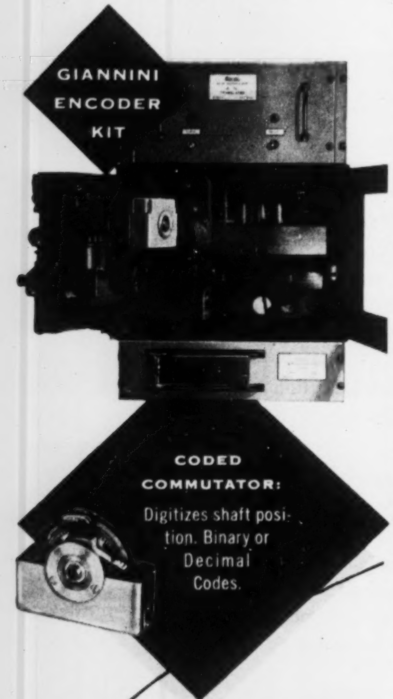
Non-linear calibrations available for use with thermocouple applications.



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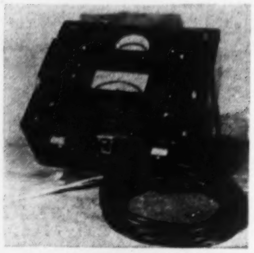
For more information circle **54** on inquiry card.

NEW INSTRUMENTS



ing, and for industrial radiography, can be easily calibrated against built-in primary standard. Dosage readings can be made without having to switch off x-ray source, since ionization chamber can be charged and discharged through cable at any time by means of switches on instrument.—*The Atomic Center for Instruments & Equipment, Inc.*, 489 *Fifth Ave., New York* 17, *N. Y.*

For more information circle **432** on inquiry card.

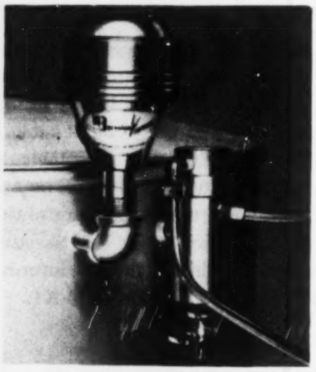
Vapor-equivalent Apparatus

New Vapor Equivalent Apparatus is for measurement of the volume of vapor which is equivalent to a unit volume of liquid after it has been vaporized, hence for determination of molecular weight of liquid residues from natural gas samples; can be applied to any liquid which has a vapor pressure of more than 4 mm. Hg at temperature of vaporization bulb. It comprises a vaporization bulb with an integral multiplying manometer and a removable sample entry system consisting of an orifice and matching pycnometer. It is mounted in an all-glass constant-temperature bath; is supplied with a pre-formed immersion heater.—*Instruments Sales Div., Phillips Petroleum Co., Bartlesville, Okla.*

For more information circle **433** on inquiry card.

Distilled-water Purity Safeguard

New "Ventgard" permits storing distilled water in storage tanks: protects it from air-borne contamination; prevents organic vapors, alkali and acid gases from entering tank; removes even carbon dioxide which is present (almost 500 ppm.) in average lab.—*Barnstead Still & Sterilizer Co.,* 244 *Lanesville Terrace, Forest Hills, Boston* 31, *Mass.*



For more information circle **434** on inquiry card.

Water Demineralizer

New "SD326 Crystalab Deeminac" water demineralizer has an air check valve which permits easy flow when either squeezed or used as a self-demineralizer; removes minerals and salts from tap water through medium of "Deeminite" ion exchange resin filter. Exhaustion of resins is indicated by color change from deep blue to brown. Outfit includes metal ring stand, graduated polystyrene quart-sized container, and tight-fitting polyethylene cover.—*Crystal Research Laboratories Inc.,* 29 *Allyn St., Hartford* 3, *Conn.*

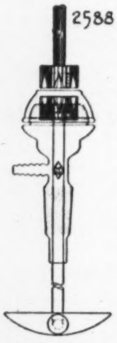
For more information circle **435** on inquiry card.

Water Demineralizer

New "Model BD-2 Pressure Bantam Demineralizer" is a cartridge-type wall-mounted demineralizer that will deliver 5 to 25 gph. of pure demineralized water under pressure so that it can be piped to any desired point, employed in pilot plant operations, used as feedwater to other devices. It employs a replaceable resin cartridge as in maker's "BD-1."—*Barnstead Still & Sterilizer Co.,* 244 *Lanesville Terrace, Forest Hills, Boston* 31, *Mass.*

For more information circle **436** on inquiry card.

Magnetic Stirrer

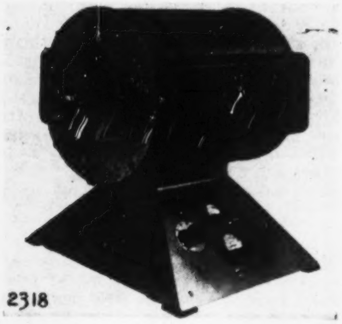

2588

New "Lew" magnetic stirrer, for vacuum, pressure or atmospheric work, can agitate liquids up to consistency of glycerin. Design is unique in that magnetic field is above vessel proper, leaving underside entirely free for application of heat or cold. This prevents glass breakage caused by friction between stirring magnet and Pyrex glass flask. Stirrer comprises an upper Alnico V magnet (with motor shaft) located outside vessel; lower Teflon-covered Alnico V magnet mounted in a well at top of a Pyrex adapter which, in turn, fits into neck of flask.—*Scientific Glass Apparatus Co. Inc., Bloomfield, N. J.*

For more information circle **437** on inquiry card.

Combustion Tube Furnace

New "Type G-02712-PT" high temperature (2600 F.) combustion tube furnace has all necessary temperature


2318

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A Midget 4-WAY Solenoid Valve
. . . For Controlling Small Double Acting Cylinders

Pipe Size: ¼"
Pressures:
Maximum 125 psi
Minimum 10 psi

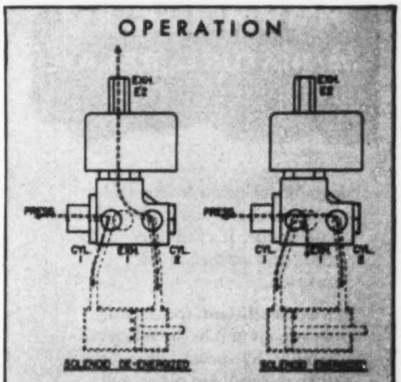
Fluids Handled:
Air, Water, Light Oil, Non-Corrosive Gases and Liquids

Extremely Compact to Meet Critical Space Requirements

FEATURING:

- **Compactness** — 4$^{15}/_{32}$" Overall Height; 1$^{31}/_{32}$" Width; 2" Depth; (With Standard NEMA I Solenoid Enclosures).
- **Rapid Operation** — Up to 400 cycles per minute.
- **Ruggedness** — Tested for millions of maintenance free operations.
- **Low Power Consumption** — Only 10 watts!
- **Tight Seating**—Assured by integral crown seats and resilient and nylon discs.
- **Standard, Watertight or Explosion-Proof Solenoid Enclosures available.**
- **Simplicity** — Single Operating Coil — only one electrical connection to be made.
- **Forged Brass Body** — Insures complete freedom from porosity.

OPERATION



When the Solenoid is deenergized, pressure is applied to Cyl. 1; Cyl. 2 exhausts.

When the Solenoid is energized the flow passage is between Press. and Cyl. 2; Cyl. 1 exhausts.

NOW ASCO has available **a complete line of Midget 2, 3, & 4-Way Solenoid Valves** — an important addition to the thousands of types and sizes in the standard ASCO line.

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We also design and manufacture Control Panels to provide "Single Source Responsibility" for the Complete Automatic Control. ASCO Electromagnetic Control Equipment includes Close Differential, Time Delay, and Magnetically or Mechanically Held Relays, Contactors, Automatic Transfer Switches and Remote Control Switches.

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For more information circle **55** on inquiry card.

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the new, highly efficient...

ADVANCE TQ

MINIATURE RELAY

Only .94 cu. inches in size—yet it carries 3-amp. loads in the 4PDT combination. It's available up to 6PDT, and with class "H" insulation.

It's extra efficient, too, having only one air gap in the magnetic assembly. By spring-holding the armature rigidly in place, and using cross-bar contacts, all alignment problems are eliminated. Insulation is inorganic, hence there is no gassing or bubbling.

The ADVANCE TQ telephone type operates on 90 milliwatts or less. Withstands 10G vibration (10 to 55 CPS). Ambient temperature range: −55°C to +125°C. Life expectancy: 1,000,000 cycles with cross-bar contacts. Open and hermetically sealed types. Write for details.

ADVANCE RELAYS

ADVANCE ELECTRIC AND RELAY CO.
2435-H NORTH NAOMI STREET
BURBANK, CALIFORNIA

For more information circle 56 on inquiry card.

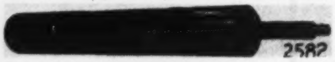
indicating and control devices located in pyramid type base; employs silicon carbide heating elements. Combustion tubes up to 2 in. can be used by changing plug inserts at ends.—*Hevi Duty Electric Co., Milwaukee 1, Wis.*

For more information circle **438** on inquiry card.

NUCLEONICS

Fast Neutron Counters

New "Mark 2 Models 201" single and multichambered directional and nondirectional fast neutron counters, in Oak Ridge critical chamber sizes, are said to "give excellent operating characteristics plus ruggedness heretofore unobtainable commercially." Counters of 1 to 3 chambers are filled with pure methane to 150-cm. pressure; operating voltage 2100. Counters having more than 3 chambers are filled to 13.2 cm. and operate at 1200 volts. With proper amplifier, excellent discrimination is obtained between gamma rays and recoil protons.—*Radiation Counter Laboratories, Inc., 5122 West Grove St., Skokie, Illinois.*

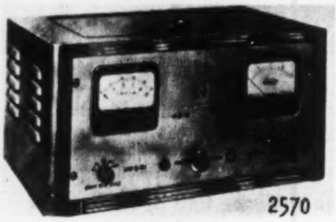


2582

For more information circle **439** on inquiry card.

Scintillation Ratemeter

New "CRM-500 Scintillation Count Rate Meter" features a fast linear amplifier with rise time of about 1 usec. and amplification of better than 1000; true pulse height discriminator adjustable to accept pulses up to 100 v.; closely-regulated high-voltage power supply; 25 response times from 1.5 milliseconds to 4 minutes; widest multiple scale of 25 to 10,000 counts per second.—*Nuclear Research and Development Co., 6425 Etzel, St. Louis, Mo.*



2570

For more information circle **440** on inquiry card.

Prospecting Counter

New "PRI Scintillator" portable battery-operated scintillation counter employs a sodium iodide crystal optically coupled to an RCA 6199 photomultiplier tube; is suitable for aerial and ground prospecting surveys and may be used for health-physics laboratory surveys. Six ranges: 0.025 to 25 mr./hr. Low-voltage (radio-type) batteries in container which can be attached to one's belt.—*The Radiac Company, Inc., 489 Fifth Ave., New York, N. Y.*

For more information circle **441** on inquiry card.

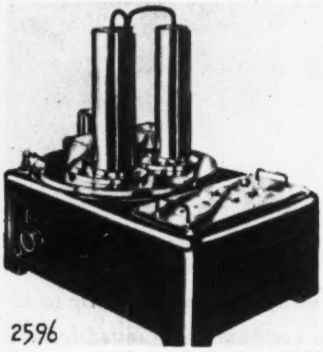
Radioactivity Scaler

New "Model 161A" scaler for use with Geiger or scintillation counters features up to 120,000 counts per minute with only 1 percent "coincidence loss"; is a complete electronic unit requiring only a detector and an accurate timer; has a scaling factor of 256, stabilized built-in high-voltage supply for detector, and 6-digit register.—*Nuclear Instrument and Chemical Corp., 229 W. Erie St., Chicago 10, Ill.*

For more information circle **442** on inquiry card.

Automatic Flow Counter

New completely-sealed automatic flow counter accommodates up to 25 samples (up to 1⅞-in. diam. and 5/16-in. high); enables obtaining automatic radioassays with a windowless Geiger or proportional counter; continuously keeps all samples under gas flow; provides high accuracy and reproducibility without long pre-flush and gas waste; may be set to count each sample 1, 2, 3 or 4 times, or for cycle-repeat. A switch permits by-passing any desired number of samples and advancing index accordingly. Over-all accuracy about 1 percent; resolving time (for Geiger counting) about 150 usec.—*Tracerlab Inc., 130 High St., Boston 10, Mass.*



2596

For more information circle **443** on inquiry card.

PHOTOGRAPHY, etc.

High-speed Framing Camera

New "Model 222" produces high-resolution photographs at rates as high as 2.4 million per second. Image of subject is focused on turbine mirror through a highly-corrected 24-in. achromat, is relayed 1-to-1 to film plane on a 30-in. radius through 25 pairs of adjustable achromats. Plano-concave, field-flattener lenses are located at each frame position within 0.002 in. of film emulsion surface. A total of 25 frames per run can thus be exposed on stationary perforated

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For Industry - Medicine - Research

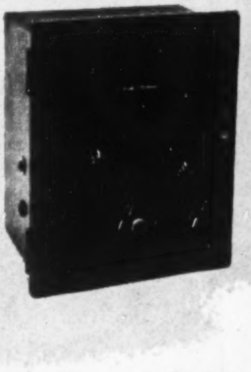
Model D

Model C

Model E-2

Model F-3

Model G-2



Operating on the unique paramagnetic (attracted into a magnetic field) property of oxygen, these instruments provide many unique advantages . . .

SELECTIVITY:

Highly sensitive to oxygen. Effects of gases other than oxygen are negligible.

MANY RANGES:

Full scale ranges from 0-1000 PPM or up to 0-100% O_2 available. Combustion ranges 0-5, 0-10, 0-15% O_2 supplied with 0-25% O_2 air check range. Multi-range instruments available.

HIGH ACCURACY:

1% of full scale (Example: ±0.05 on range 0-5% O_2) for industrial and laboratory instruments.

RAPID ANALYSIS:

A 95% response is obtained in 45 seconds with standard instruments... with special instruments in 7 seconds!

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Instruments designed for portability, recording, indication, explosion-proof operation and equipped with many other desired features are available.

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For more information circle **57** on inquiry card.

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ENVIRONMENTAL TEST EQUIPMENT

SAND & DUST test chambers with completely automatic dust density control.

ALTITUDE chambers for testing from sea level to 100,000 ft. or higher with temperatures from −100° F to +200° F.

HUMIDITY chamber simulates relative humidity from 20% to 100% between +35° F and +200° F.

American Research offers a complete line of Environmental Test Equipment for simulating conditions of high and low temperature, altitude, relative humidity, sand and dust, rain and sunshine, fungus, explosion, etc.
Designed and built in a variety of sizes and ranges to meet all government specifications and individual requirements.

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For more information circle **58** on inquiry card.

35-mm film. Control unit (right) can be located up to 35 ft. from camera.—*Beckman & Whitley, Inc., 930 San Carlos Ave., San Carlos, Calif.*

For more information circle **444** on inquiry card.

Portable Copying Machine

New "Private Eye Auto-Stat" low-cost portable photocopy machine can be carried by any office girl and, by plugging it into electrical outlet, is ready for operation. No chemical trays, running water, wet hands or ammonia fumes. A finished copy can be made by an inexperienced operator in two steps requiring less than 45 seconds. Copies up to 11x17 in.; whether original is printed on one or both sides, or on opaque or translucent paper.—*American Photocopy Equipment Co., 1920 W. Peterson Ave., Chicago 26, Ill.*

For more information circle **445** on inquiry card.

PRESSURE and LOAD

Pressure Transmitter

2539

New "Model GPT," designed primarily as an absolute pressure transmitter, is available in types for gage and differential pressures, in ranges of 15 to 80 psi. Among features: isolation of voltage-dividing resistors from actuating pressure; output linear with pressure; resolution 0.34 percent of full-scale for standard voltage dividers; no damage from 40-*G* shock on any axis; operating temperature range −50 C. to 90 C. with 2 percent maximum effect at temperature extremes.—*Genisco, Inc., 2233 Federal Ave., Los Angeles 64, Calif.*

For more information circle **446** on inquiry card.

Master Gages

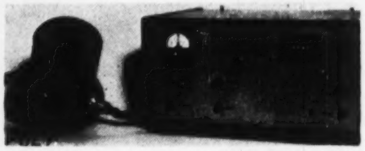
New "Deluxe Serviceman Testing Gauge Set" consists of two 2½-in. dial gages; one graduated 0-400 psi.; other is a compound retard gage graduated 30 in. by 250 psi. Both have corresponding temperature scales for Freon 12 and Freon 22.—*Jas. P. Marsh Corp., 3501 Howard St., Skokie, Ill.*

2684

For more information circle **447** on inquiry card.

Digital-output Pressure Indicator

New "Type 37-103 Precision Pressure Balance" is said to provide a laboratory standard for precise calibration of pressure pickups with accuracy comparable to highest-quality manometers; indicates on a counter with digits to 9999. Readings may be held when required or attached to electrical tabulating devices through 0-to-10-volt d-c. output. Operating principle is dynamic force balance. Pickup is suitable for differential pressure, gage pressure, and absolute pressure. Various ranges available.—*Consolidated Engineering Corp., Pasadena 8, Calif.*



For more information circle **448** on inquiry card.

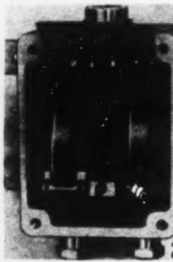
Absolute Pressure Pickup

2696

New "Type P-1" features a new principle of bellows linkage, whose motion is used to rotate a "Type AY Autosyn" and produce a phase-sensitive emf. proportional to pressure. Excitation at 1,000 cps. can be increased to 65 v. rms., thus yielding exceptionally high sensitivity. Excitation at 400 cps. is 26 v. rms. and proportionately lower for 60 cps. Accuracy is better than 1.5 percent throughout range. Ranges can be furnished from vacuum to 500 psia.—*E. V. Naybor Labs., 30 Manorhaven Blvd., Port Washington, N. Y.*

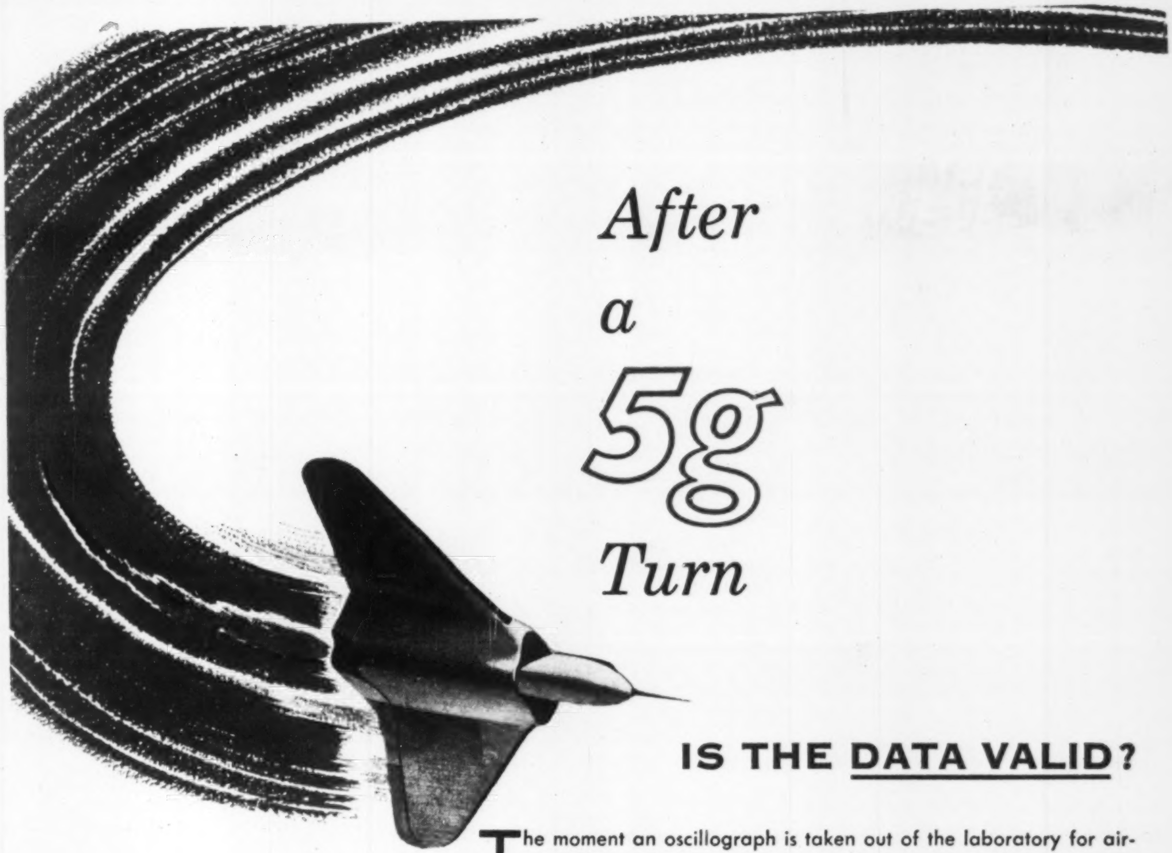
For more information circle **449** on inquiry card.

Pressure-difference Switch



2613

New "Meletron Model 532" senses a pressure difference between two variable pressures or a variable and a reference pressure; is available in four classes of proof pressures from 500 to 12,000 psi.; permits opening or closing of a circuit on increasing or decreasing pressure difference from



After a 5g *Turn*

IS THE DATA VALID?

The moment an oscillograph is taken out of the laboratory for aircraft flight testing, vehicle road tests, or any application where vibration and dynamic g forces are present, the "balance" of its galvanometers—the measure of their response to gravitational force—becomes all-important. An unbalanced galvanometer can cause deflections—under only moderate g-loadings—large enough to distort a data trace and make accurate record interpretation impossible. It can show deflections even when no data signal is present.

Miller Instruments' *improved* galvanometers are supplied *at no extra cost* with balance so closely controlled that trace deflection is within 0.010" per g in elements of less than 300 cps natural frequency and within 0.001" per g for higher frequencies. The unique open construction allows balancing to be the *final* operation before shipment. No subsequent assembly steps disturb the balance achieved. Trace deflection due to g forces displacing the suspension is negligible.

Sound basic concept and extreme care in manufacturing and testing make Miller Galvanometers unequalled not only in their balance but also in their control of sensitivity, linearity and stability. Inaccuracies have been literally "designed out." The unusual fineness of the traces they produce have long been the standard in oscillographic recording.

Available with natural frequencies from 35 to 3200 cps and a wide range of sensitivities, Miller Galvanometers are described in detailed literature, which will be sent on request.

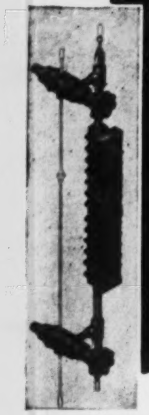
Wm MILLER INSTRUMENTS, INC.

CUSTOM INSTRUMENT DESIGNERS AND MANUFACTURERS

325 N. HALSTEAD AVENUE • PASADENA 8, CALIF. • RYAN 1-6317

For more information circle **59** on inquiry card.

get accurate level reading of hot or cold liquids



Reflex type, internal tube model

with Jerguson Heated and Cooled Gages

Here's your answer if you have the problem of getting accurate level readings of liquids that boil or surge or liquids that are heavy and don't flow at normal temperature. Jerguson Heated and Cooled Gages are specially designed and built to carry a cooling circulating medium to control boiling tendencies . . . or a heating circulating medium to speed the flow . . . so you get *accurate* readings. These gages are also ideal in cold weather applications for they can be heated to prevent gage freezing and breakage.

Jerguson's high standards of design are followed throughout; and materials are selected to exceed or conform to A.I.S.I., A.S.T.M. and/or A.P.I.-A.S.M.E. requirements. Available in external or internal tube models, reflex or transparent types, in a large number of sizes and pressure groups.

You'll get rid of the troublesome problems involved in steam tracing and won't have to insulate gages or valves, you'll eliminate the problem of getting accurate level readings of hot or cold liquids, and you'll cut maintenance hours and costs with Jerguson Heated and Cooled Gages. Send for detailed Data Unit and full information.

JERGUSON

Gages and Valves for the Observation of Liquids and Levels

JERGUSON GAGE & VALVE COMPANY
100 Fellsway, Somerville 45, Mass.
Offices in Major Cities
Jerguson Tress Gage & Valve Co., Ltd., London, Eng.
Pétrole Service, Paris, France

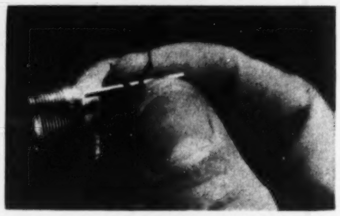
For more information circle **60** on inquiry card.

15 to 10,000 psi. at any point within adjustable range of model selected. Other features: operates in any position; splash-proof enclosure; tamper-proof external adjustment.—*Barksdale Valves*, 5125 *Alcoa Ave., Los Angeles* 58, *Calif.*

For more information circle **450** on inquiry card.

Fluctuating-pressure Pickup

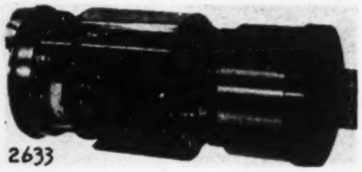
New design of "Sierra Brand Transducer" strain-gage-type pickup has reference-pressure tube at rear together with electrical terminals, permitting unit to be threaded into its flush-mounting position from either direction. Another refinement is gold-plating of external metal areas. Having taut diaphragm flush with surface against which pressure is to be measured, pickup is said to "eliminate phase and amplitude errors which can arise in systems involving pneumatic tubing connections or transducer volumes." Available pressure ratings from 2.5 to 200 psi.; linearity, 2 percent; operating temperature range, −40 to 250 F.; resonant frequency of diaphragm, 8,000 cps.—*Electronic Engineering Associates, Ltd.*, 1005 *Brittan Ave., San Carlos, Calif.*



For more information circle **451** on inquiry card.

Variable-frequency-type Pressure Transmitter

New "Series P300," for differential or gage pressures in non-corrosive liquids or gases, is available in ranges from ±3 psi. to ±100 psi.; incorporates an FM oscillator and a variable-inductance pressure-measuring element; changes pressure to proportional frequency supplied at constant amplitude across output terminals. Center frequencies from 1000 to 80,000 cps. are offered. Sensitivity change with temperature is less than 0.02 percent per F. deg. and zero drift is less than 0.02 percent of bandwidth per F. deg. High natural resonant frequency: about 2000 cps. in ±10-psi. range. New transmitters, though designed primarily for FM/FM telemetering, are suitable for laboratory, for industrial liquid level measurement and control, etc. Length 3⅛ in.; weight 6½ oz.—*Datran Engineering Corp.*, 6312 *W. 92nd St., Los Angeles* 45, *Calif.*



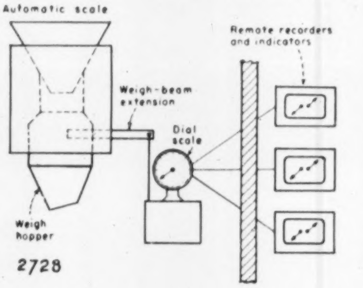
2633

For more information circle **452** on inquiry card.

Pressure Transmitter

New "Pressure Meter" is said to utilize "an entirely new principle of measurement . . . This discovery measures any phenomenon which can be resolved into changes of capacitance, resistance, or inductance." It replaces

Remote Load Indicators and Recorders



2728

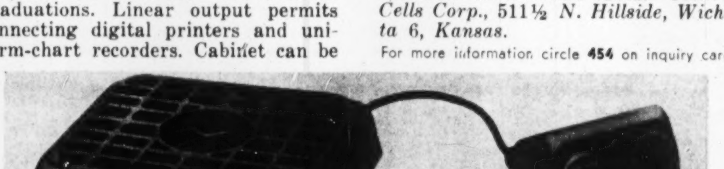
New remote indicators and recorders with standard accuracies of one part in 2000 (higher accuracies if desired) precisely follow a prime-mover dial scale. Weight of material fed to automatic scale's weigh hopper is indicated on dial scale and these readings are synchronized and duplicated remotely: recorded on circular charts, strip charts or tape printers. Remote units may be hooked up to any industrial-make scale dial, and any number of units may be run by one prime-mover.—*Richardson Scale Co., Van Houten Ave., Clifton, N. J.*

For more information circle **453** on inquiry card.

Electrical Load-indicating Systems

New "Electronic Scale" comprises an 11 x 14 x 3½-in. force transmitter available in capacities up to 40,000 lbs., and an indicator with uniform graduations. Linear output permits connecting digital printers and uniform-chart recorders. Cabinet can be installed on vehicles, in ships, etc. Features: load cell output is 1000 times that of strain-gage type; system uses no electron tubes.—*Control Cells Corp.*, 511½ *N. Hillside, Wichita* 6, *Kansas.*

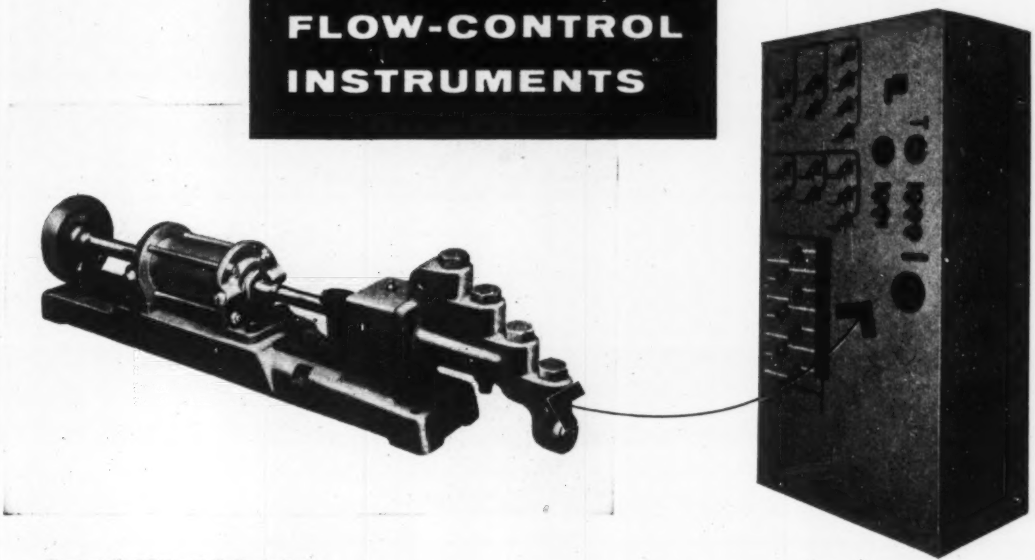
For more information circle **454** on inquiry card.



2631

CONTROLLED VOLUME PUMPS ARE FLOW-CONTROL INSTRUMENTS

This Milton Roy graphic panel provides centralized control and monitoring of 23 air-powered Controlled Volume Pumps to regulate a continuous polymerization process.



Typical "alROYmetric" Controlled Volume Pump. Air-powered pumps have a capacity range of from .04 to 405 gallons per hour against pressures up to 25,000 pounds per square inch. Capacity can be varied manually or automatically.

MILTON ROY GRAPHIC PANEL CONTROLS CONTINUOUS PROCESS

Flow controllers, ratio controllers and final control elements . . . these are the functions performed by 23 Controlled Volume Pumps in automatically controlling a continuous process.

This graphic panel—installed after full study and pilot plant testing—provides centralized control and monitoring of all 23 Controlled Volume Pumps used in the process. Some of these pumps control the flows and maintain the ratios of process streams. Others are used as final control elements, controlling the flow of catalyst in response to process demand, as dictated by the reactor temperature controller.

Milton Roy Controlled Volume Pumps are flow-control instruments that can *solve your flow-control problems.* Our Engineering Services include detailed recommendations on pumps, process instrumentation, accessories, panel design and construction.

Reference Literature: Write for Application Engineering Data Sheet A-54-2 "Instrumentation of a Continuous Reactor" and Bulletin 1053 "Air-Powered Controlled Volume Pumps."

See the **MILTON ROY EXHIBIT**
BOOTHS 131-136
First International Instrument Congress and Exposition
PHILADELPHIA—SEPTEMBER 13-24, 1954

MILTON Roy COMPANY

Engineering representatives in the United States, Canada, Mexico, Europe, Asia, South America and Africa.

Manufacturing Engineers 1309 E. MERMAID LANE • PHILA. 18, PA.

CONTROLLED VOLUME PUMPS AND AUTOMATIC CHEMICAL FEED SYSTEMS

For more information circle **61** on inquiry card.

SCAM: FIRST
with these broad and basic developments in the ANNUNCIATOR FIELD!

FIRST AUTOMATICALLY AND CONTINUOUSLY SELF-SUPERVISED CIRCUIT.

With the DE Line, Scam pioneered the development of self-policing alarms with many new and versatile features. Each standard Plug-In operates from either NO or NC field signals . . . each has a simple lock-in for momentary alarms . . . each has an auxiliary contact for remote indication either NO or NC. Scam Special Plug-Ins provide HI-LO Level indication and sequential signals.

FIRST WITH STANDARD, COMPACT CABINET DESIGN.

Scam single-three-five-seven or eleven-unit cabinets require the least panel area and may be arranged in a variety of ways to provide maximum utility. Any Scam plug-in —special or standard—fits into the Cabinets without any chassis wiring changes.

FIRST TO OFFER AN ECONOMICAL, COMPACT, SINGLE-DUTY, SELF-MONITORING ALARM.

The Fail Safe *Econ Line* made possible positive identification of trouble sources and offered industry an opportunity to extend alarm usage on an economical and practical basis.

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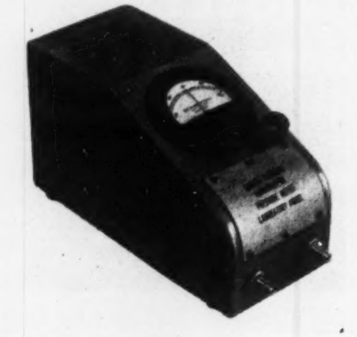
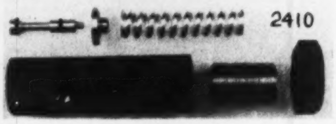


an impedance bridge, a phase-sensitive rectifier, and a voltage amplifier; requires only a power supply and a power amplifier to drive a recorder or indicator. Unit illustrated is a differential-pressure model, with output of 0.25 volt/micron Hg (5 volts per mm. of water); is capable of linearity of better than 0.1 percent.—*Decker Aviation Corp.*, 1361 *Frankford Ave., Philadelphia* 25, *Pa.*

For more information circle **455** on inquiry card.

Pressure Gage Protectors

New "Gauge Cutout" protects against excessive line pressures; responds at pressures as low as 10 psi. Two models: low-pressure, with ranges from 10 to 300 psi.; high-pressure, from 100 to 3000 psi. A low-rate spring may be substituted. In LP model, it introduces high operational efficiency at 10-60 psi. range; in HP model, from 100 to 600 psi.—*Greer Hydraulics, Inc.*, 454 18*th St., Brooklyn* 15, *N. Y.*

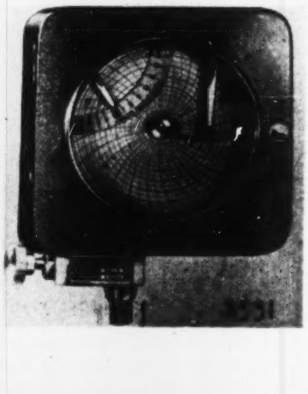


For more information circle **456** on inquiry card.

FLOW and VOLUME

Gas Flowmeter

New indicating and recording argon or oxygen flow-rate meter, for use in controlling and determining argon gas welding costs, is adaptable to either a regulated cylinder supply or a piped system. Two models: with 4½-in. chart for ranges from 0-15 lpm. to 0-100 cfh.; and with 10-in. chart for ranges from 0-25 to 0-300 cfh. Each is furnished for inlet pressure at 20 to 50 psi. as specified.—*Elematic Equipment Corp.*, 6731 *S. Chicago Ave., Chicago* 37, *Ill.*



For more information circle **457** on inquiry card.

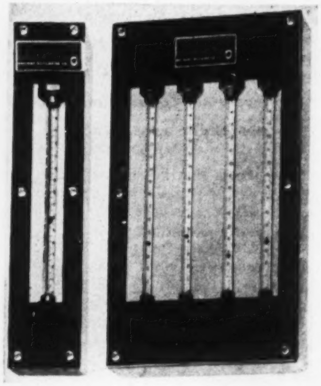
Automatic Flow Switch

New "Shur-Flo," operated by differential pressure across its orifice, protects equipment requiring a definite flow of fluid. It will cut off equipment or provide a signal when flow falls below safety rate. Available in ½-in. size (control points anywhere from 0.1 to 8 gpm.) and 1¼-in. size (8 to 40 gpm.).—*Industrial Sales Div., Hays Mfg. Co.*, 812 *W.* 12*th St., Erie, Penn.*

For more information circle **458** on inquiry card.

Flow-rate Indicator

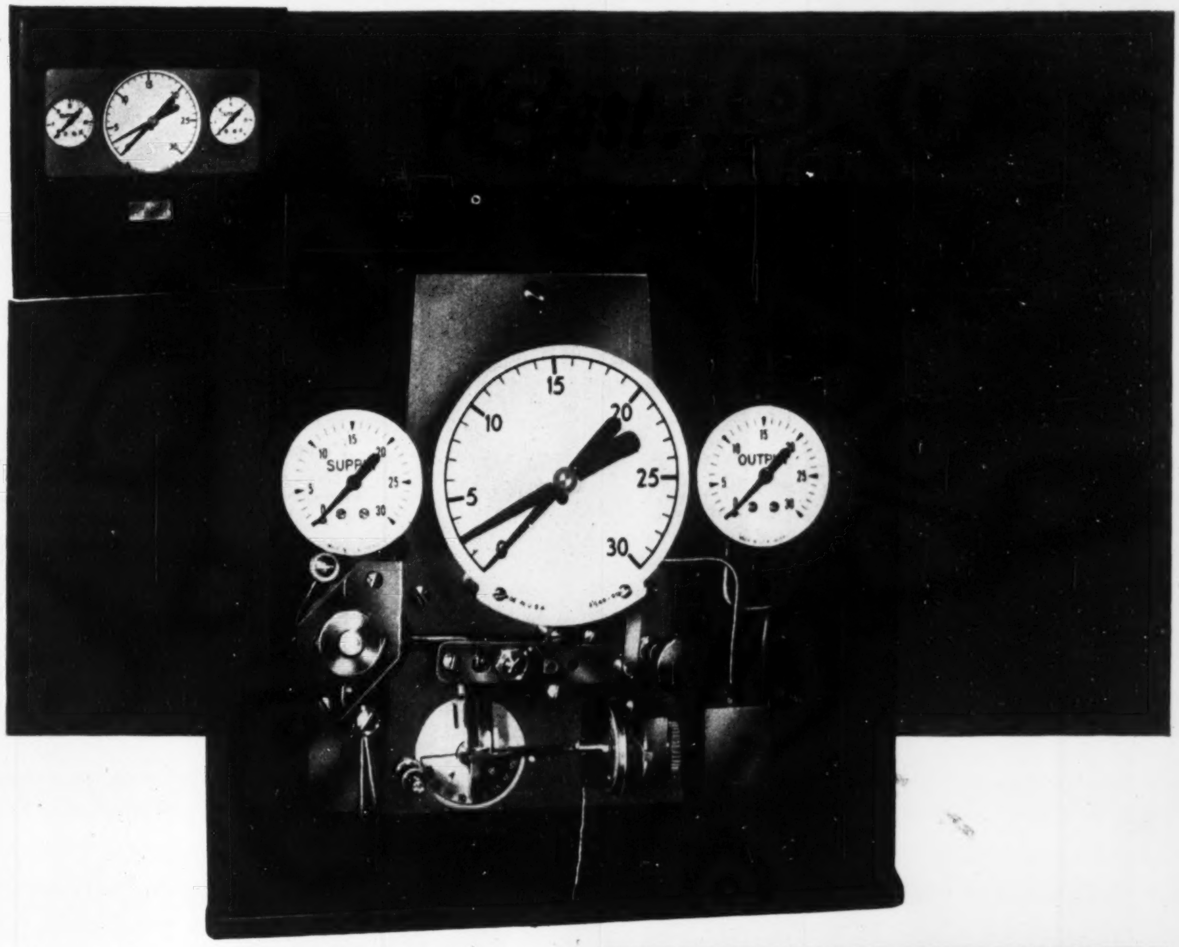
New "Flow-Mizer" is a single- or multi-tube flow-rate indicator for noncorrosive liquids and gases at moderate pressures; may be flush panel mounted or installed in pipeline. Available ranges 0.05 cc./min. to 15 gpm. of water and 5 cc./min. to 25 cfm. of air. ★ "Dual Range Flow-Mizer" eliminates changing tubes and floats by utilizing two floats in a single metering tube—*Brooks Rotameter Co., P. O. Box* 432, *Landsdale, Penna.*



For more information circle **459** on inquiry card.

Current Meter

New salt-water model of maker's current meter has a commutator which indicates each tenth revolution of



one pressure pilot that has everything the new K & M MODEL 54

Make your own comparison. In compact, self-contained design . . . in flexibility of control action, the new Model 54 Pressure Pilot is a long step ahead of the field.

No separate indicating gauge is necessary . . . controlled pressure is clearly readable on a 6¾" scale on which a red pointer shows the control point setting.

No complicated adjustments or linkage changes . . . 0 to 100% throttling range or differential gap adjustment means simply turning a dial. Only a screw driver is needed to change from direct to reverse action, throttling to snap-action differential gap control.

COMPARE PRESSURE PILOT FEATURES

Features	K&M PILOT	PILOT B	PILOT C	PILOT D
Controlled Pressure Indication	YES	NO	NO	NO
Calibrated Setting	YES	NO	NO	NO
Relay Operation	YES	YES	NO	NO
All Metal Construction	YES	NO	YES	YES
Orifice Cleaner	YES	YES	NO	NO
Feedback	YES	YES	NO	YES

And, to clean the sapphire feed orifice, no disassembly is required . . . simply press a button, that's all.

Add to these features greater stability achieved through a diaphragm feedback and a trouble-free all-metal relay. All these features contributing to control performance and simplified operation are available *without extra cost* in the new K & M Model 54 Pressure Pilot. Write for information today.

K&M

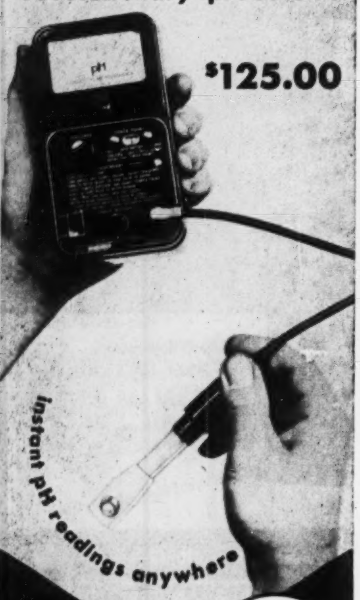
diaphragm control valves and regulators
Since 1879

64 Genung Street
Middletown, New York

For more information circle **63** on inquiry card.

PROBE into your pH problems on-the-spot

with the Analytical pocket pH meter and revolutionary probe unit



Completely self-contained in waterproof ever-ready case with shoulder strap.

Instrument size: 3 x 5⅞ x 2½ inches
Case size: 3¾ x 6½ x 4⅛ inches
Weight with accessories: 3 lbs.

Permits continuous, direct reading of pH
No buttons to hold down or dials to turn.

Analytical Measurements, Inc.
585 MAIN ST. CHATHAM, N. J.

Analytical Measurements, Inc.
585 Main Street, Chatham, N. J.
Please send full information to:
Name ____________
Company ____________
Address ____________
City ____________ State ____

Be sure to visit us at Booth 407 during the First International Instrument Congress & Exposition.

For more information circle **64** on inquiry card.

bucket wheel (single-rev. commutator can also be supplied). Commutator box is positively sealed.—*W. & L. E. Gurley, Troy, N. Y.*

For more information circle **460** on inquiry card.

Loss-in-weight Recorder

New redesigned and improved equipment for checking and recording rate of feed of volumetric feeders by Loss-In-Weight method is now available for small as well as large chemical feeders.—*Omega Machine Co., 345 Harris Ave., Providence, R. I.*

2458

For more information circle **461** on inquiry card.

DISPLACEMENT, VIBRATION, ACCELERATION

Displacement Pickup

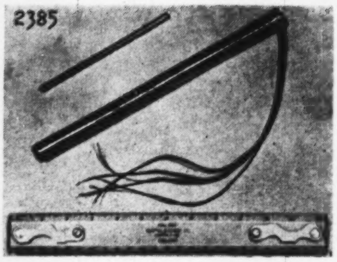
New "Type 910 Potentiometer" features flexibility of design; provides for many variations in linear-motion type of pickup: dual resistance elements, various stroke lengths, double shaft extensions, room for internal fixed resistors, and various methods of actuating. Rigid mechanical construction provides tight electrical tolerances initially and through severe service.—*Fairchild Camera & Instrument Corp., 225 Park Ave., Hicksville, L. I., N. Y.*

2401

For more information circle **462** on inquiry card.

Displacement Pickup

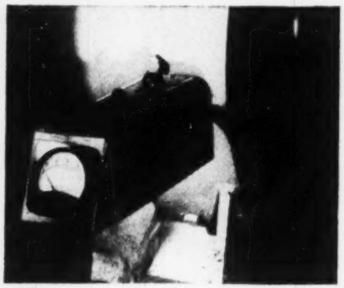
New "Linearsyn Model 7S2" long-stroke shielded differential-transformer linear-motion displacement pickup has 4-in. stroke range in which output is linear with input (plus and minus 2 in. about null position) when excited with 2- to 10-kc. a-c. voltage. Linear range is decreased somewhat when excitation frequency is outside this range; e.g., 3 in. at 400 cps.—*Control Components Co., Brookline Village, Brookline, Mass.*


2385

For more information circle **463** on inquiry card.

Portable Vibration Meter

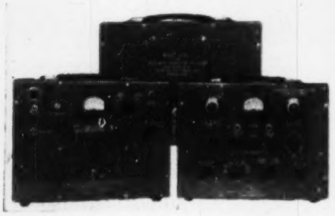
New "Type VHA" direct-reading portable vibration meter measures both displacement and acceleration. Frequency range 10-250 cps; six acceleration ranges 0-0.03 to 0-10*G*; five peak-to-peak displacement ranges 0-3 to 0-300 mils. Instrument employs a barium titanate acceleration pick-up and its performance is not affected by magnetic fields. It operates on hearing-aid batteries. Calibration easily checked; weight about 5 lbs.; pistol-grip, trigger-type switch.—*Meter & Instrument Dep't, General Electric Co., West Lynn 3, Mass.*



For more information circle **464** on inquiry card.

Resonant-vibration Plotter

New resonant vibration plotter, for analysis of mechanical vibrations, automatically plots vibration amplitude as function of frequency; features scale expansion; is packaged for portability.—*Franklin Electronics, Inc., 415 W. Pike Street, Philadelphia 40, Pa.*



For more information circle **465** on inquiry card.

Vibration Recorder

New "Askania Universal Vibrograph" is a portable (26-lb.) instrument for recording accelerations and vibration displacements of vehicles,

CLARE

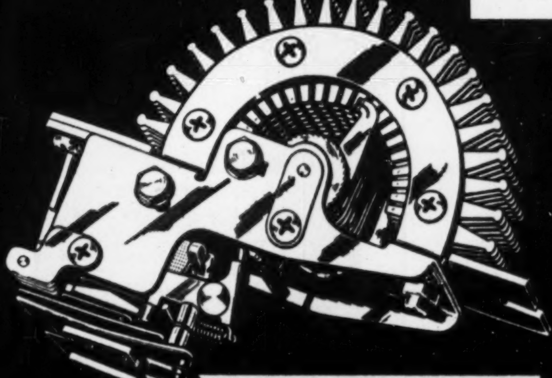
Stepping Switches meet wide range of circuit selection and control problems

CLARE Spring-Driven Stepping Switches are uniselectors, or rotary switches, for completing, interrupting, or changing the connections in, a succession of electric circuits in response to momentary impulses of current.

The switch consists essentially of one or more wiper springs, fixed to a shaft, rotated by a pawl and ratchet mechanism, actuated by an electro-magnet which responds to current impulses. These impulses may be from an external pulsing device or produced by the switch itself, by interrupter springs operated by the magnet armature. Additional contacts may be included in this spring assembly to perform other desired control or signal functions. Remote control operation speed is 30 steps per second maximum. Automatic operation may be as high as 60 steps per second on 48 volts dc or 115 volts ac (with rectifier).

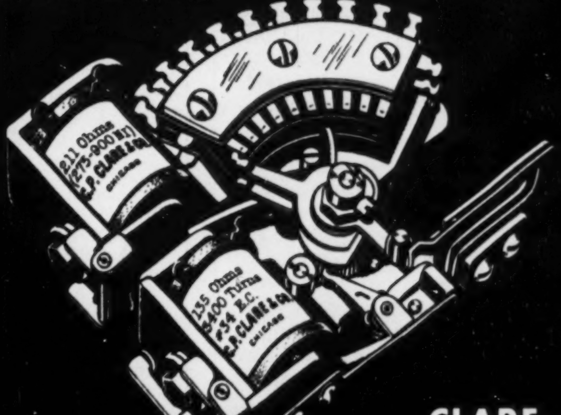
CLARE Direct-Drive Stepping Switches are operated as the stepping magnet drives the pawl into the ratchet to move wiper assembly. Wipers are held in place by a detent when magnet is de-energized. Pawl is returned to normal by a spring. Circuit may be held closed for any desired time after final step. Pawl is normally disengaged from ratchet, and wiper assembly can be returned to normal by a reset magnet. Maximum operating speed: 35 steps p. s. under ideal pulsing conditions. Release time is 0.030 to 0.070 second depending on voltage and the position from which wipers are released.

CLARE Spring-Driven Stepping Switch



TYPE	CAPACITY
20	1 to 8 levels, 20-point
26	1 to 10 levels, 26-point
40	1 to 4 levels, 40-point
52	1 to 5 levels, 52-point

A versatile, high-speed switch for—
Selecting desired point of a series
Sequence control • Counting and totalizing
Monitoring



CLARE Direct-Drive Stepping Switch

Designed for such control functions as—
Selecting one circuit path out of ten
Consecutively performing operations in separate individual circuits

Send for Engineering Bulletin No. 103 for a discussion of stepping switch operation and applications. For full technical data ask for Engineering Bulletin No. 101. Address C. P. Clare & Co., 3101 West Pratt Blvd., Chicago 45, Illinois. In Canada: Canadian Line Materials Ltd., Toronto 13. Cable Address: CLARELAY

For more information circle **65** on inquiry card.

CLARE RELAYS

subminiature accelerometer
Accelerometer Ser. No. 125
F-10-350 10 V exc.
Statham Laboratories
MODEL F

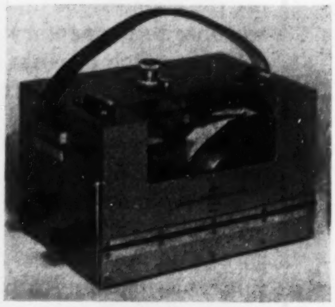
To detect and measure static or dynamic acceleration in ranges from ±2 g to ±100 g, the Model F accelerometer is available for applications requiring miniature components.

Weighing less than one ounce, this accelerometer can be attached to light machine parts without altering their dynamic performance, or it may be inserted into small spaces previously inaccessible for vibration measurements. At no sacrifice in performance, extremely small size and weight are emphasized in the Model F accelerometer.

Please request Bulletin No. 4.0.

Statham
LABORATORIES
• Los Angeles 64, Calif.

For more information circle **66** on inquiry card.

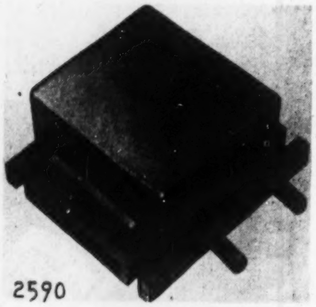


etc. Several models are available having different natural frequencies and ranges from 0.05 *G* to 10 *G*. Recording is by a sapphire stylus on waxed paper: no ink.—*European Products Importing Co., Inc.*, 154 *Nassau St., New York* 38, *N. Y.*

For more information circle **466** on inquiry card.

Temperature-controlled Acceleration Pickups

New temperature-controlled linear acceleration pickups in ranges from 0.5 to 15 *G* (plus and minus), perform reliably under changing temperatures as encountered in flight applications. In order to maintain 0.7 damping ratio providing largest region of uniform response, pickups have special packaging and an electrical heater jacket. Ambient temp. limits –65F. (or –54 C.) and 135 F. (or 57 C.). Photo shows "Model A17," from ± 1 *G* to ± 15 *G*, employing maker's unbonded resistance strain gage principle for converting force into electrical output.—*Statham Laboratories, Inc.*, 12401 *W. Olympic Blvd., Los Angeles* 64, *Calif.*


2590

For more information circle **467** on inquiry card.

SPEED

Variable Speed Control

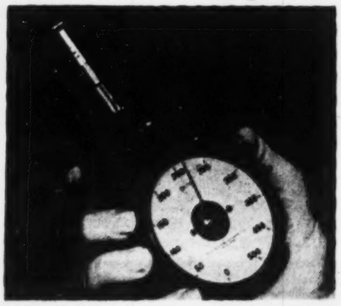
New "Servospeed" system is specifically designed for laboratory use. Motors and control system from 1/400th to 1/30th hp., and gear-motor ratios from 6:1 to 1120:1 reduction, are available. One base motor speed: 1750 rpm.; speed ranges as low as 0.08 rpm. to 1.6 rpm.—*Electro-Devices, Inc.*, 4-6 *Godwin Ave., Paterson, N. J.*

2525

For more information circle **468** on inquiry card.

Hand Tachometers

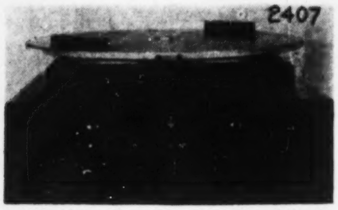
New models of "Smiths Tachometers" utilize time-tried principle (auto speedometers, etc.) of magnetic drag: a cylindrical Alnico magnet is rotated, through range-selection gearing, within an aluminum cup. Temperature compensation and overspeed protection are built-in and guaranteed accuracy is 0.5 percent. Stop button holds pointer reading when desired.—*Clarence J. Marx Co., P. O. Box* 4033, *Cleveland* 23, *Ohio.*



For more information circle **469** on inquiry card.

Frequency Strobe System

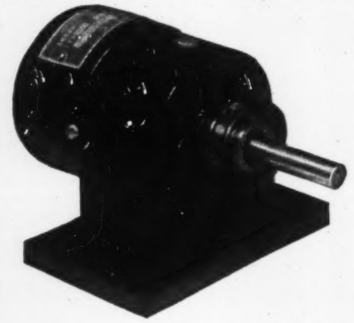
New precision stroboscopic monitoring system has been added to maker's Rate-of-Turn Table for gyro development and testing. Accuracies of flashes are controlled to one part in one million.—*Genisco, Inc.*, 2233 *Federal Ave., Los Angeles* 64, *Calif.*


2407

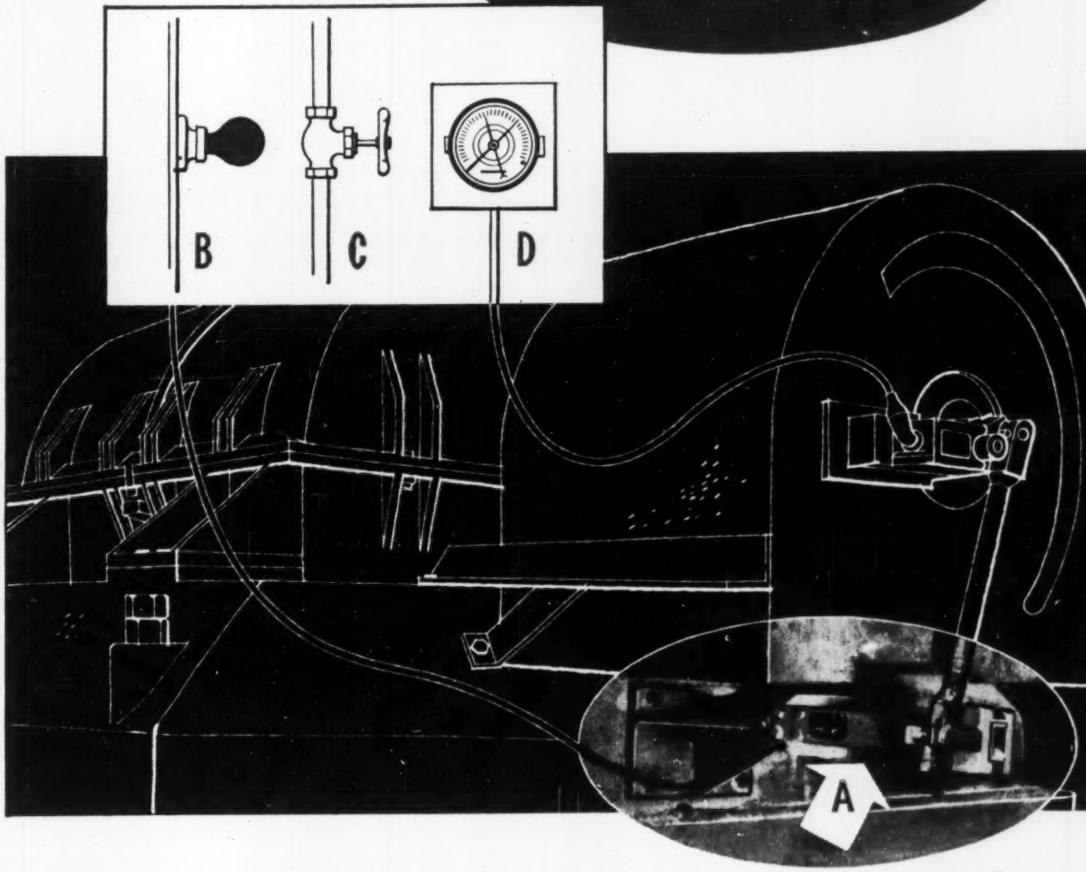
For more information circle **470** on inquiry card.

Direction and Zero-speed Indicating Contactors

New "Model 1025" of "Dazic" direction and zero-speed indicating contactors can also be adapted as a



PACKAGED PRECISION
MEASUREMENT



Prominent plastics plant reports: "We avoid costly downtime by *automatic,* remote load control"

One of the leading plastics manufacturers reports they are getting three-way protection against downtime by using Baldwin's SR-4® Load Measuring System of simplified load control on centrifuges separating polyvinyl resin powders.

First, if the load, measured on an SR-4 Load Beam (A), exceeds a set value, the operator's attention is attracted by a signal lamp (B), and he reduces the feed rate by a hand control (C).

Second, if the load increases too quickly for manual feed reduction, the controlling electric circuit (D) shuts off the drive motor.

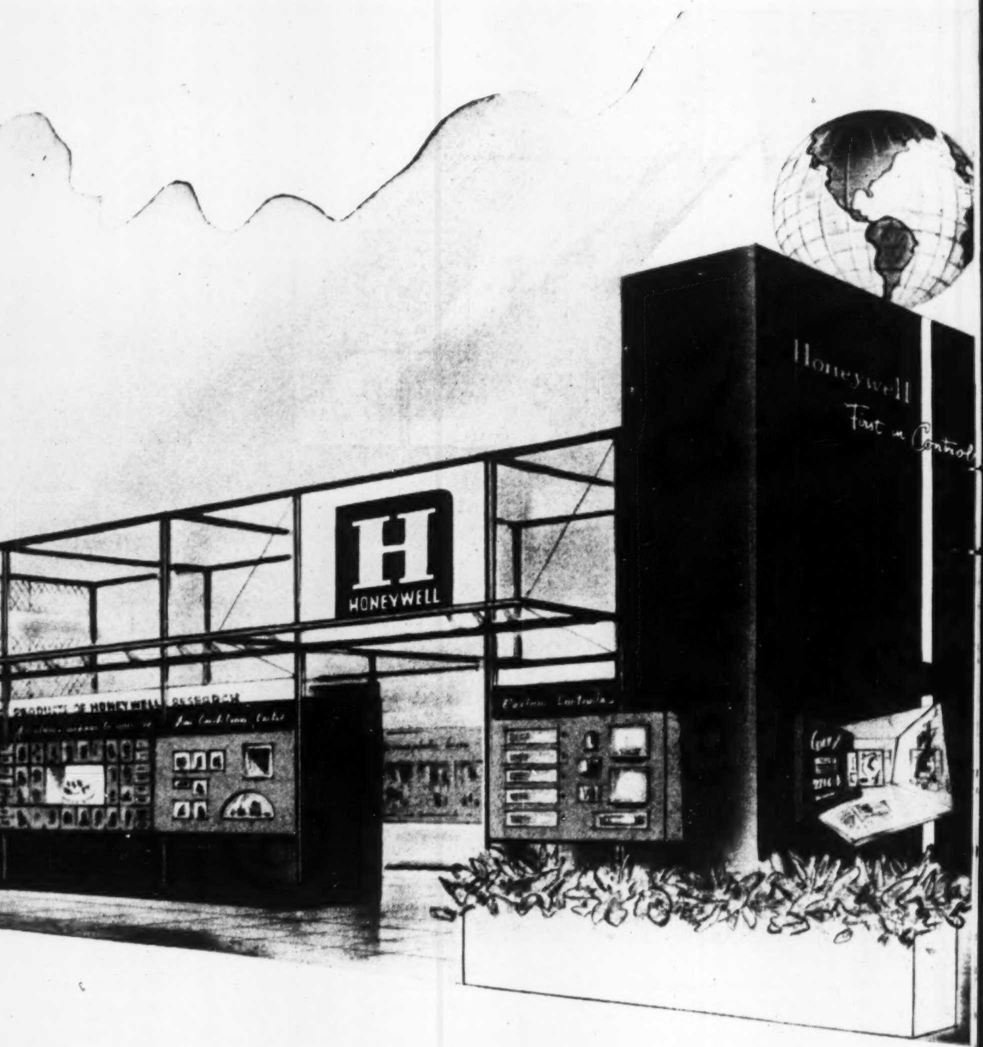
Third, shear pin (E) breaks to shut down drive motor only as last resort. SR-4 system virtually obviates this, avoiding downtime that would be necessary ordinarily.

This system results in almost continuous operation of the equipment at a far lower operating cost.

You can profit, too, by using a Baldwin Packaged SR-4 Measuring System to simplify operations and save you time and money . . . whatever your load, fluid pressure or torque measurement problem may be. Send now for our illustrated bulletins that will show you how. Write today to Department 3215, Baldwin-Lima-Hamilton Corporation, Philadelphia 42, Pa.

BALDWIN-LIMA-HAMILTON
General Offices: Philadelphia 42, Pa. • Offices in Principal Cities
In Canada: Peacock Bros., Ltd., Montreal, Quebec

For more information circle **67** on inquiry card.



The world lives better, works better

INSTRUMENTATION takes on new stature and scope at the first International Instrument Congress and Exposition in Philadelphia from September 13 to 24.

Honeywell's world-wide organization extends a sincere welcome to all who come to this meeting from near or far . . . and invites you to see the many new ideas in instrumentation and control which will be displayed in the Honeywell booths.

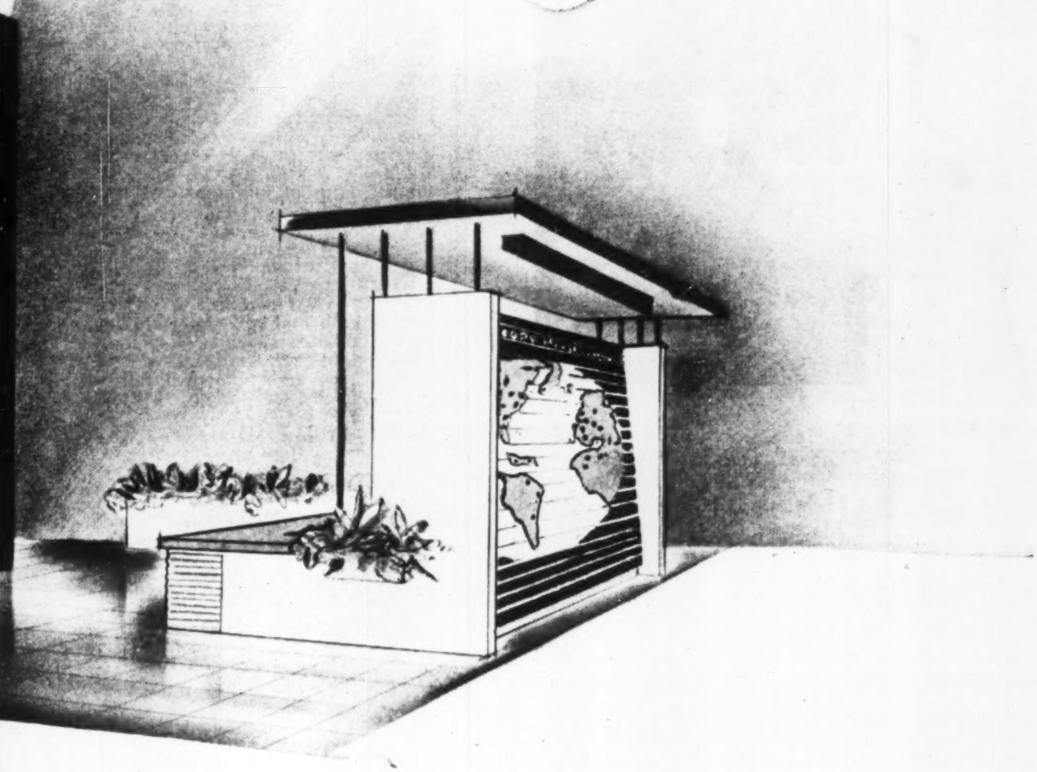
Whether your specific interest lies in industrial process controls . . . instrumentation to aid research . . . controls for heating and air conditioning of commercial and institutional buildings . . . aeronautical controls and instruments . . . you'll find products of Honeywell research that are applicable to your problems. The latest developments in *ElectroniK*, pneumatic and mechanical instruments—electric and pneumatic control systems—flow meters—pyrometer supplies and many related products—all will be shown in operating exhibits and informative displays.

Of particular interest to visitors from abroad will be the exhibit of Honeywell's extensive International Division, manned by specialists from overseas offices.

Be sure to get to the Instrument Show this year—and be sure, too, to see the latest developments by Honeywell . . . "First in Controls," worldwide.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Phila. 44, Pa.

For more information circle 68 on inquiry card.



. . . *with Honeywell controls*

You'll see how...

at the Honeywell Exhibit

in the "Instrument Show"

Booths

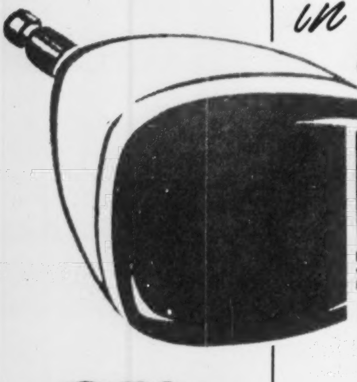
632-640, 731-739

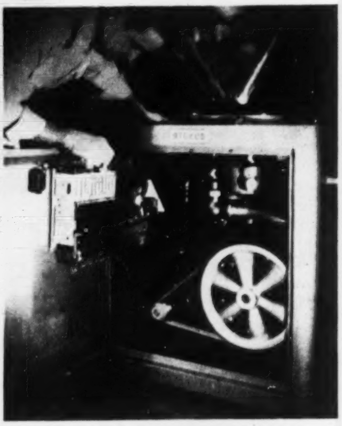
MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS

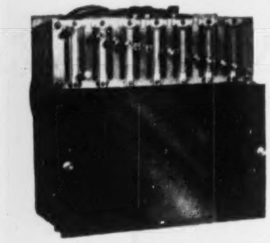
First in Controls

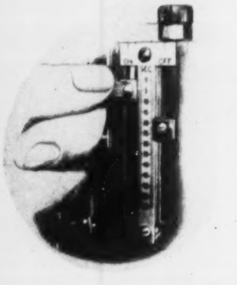
For more information circle **68** on inquiry card.

Let **EAGLE** put profit in your process









Television tubes can now be coated automatically with a new metallizing unit developed by F. J. Stokes Machine Co. All operations—closing and opening of valves,—starting and stopping of vacuum pumps,—on and off of vaporizing current,—all are controlled by one Eagle Multiflex Timer. Let Eagle timers speed up production, increase quality, and reduce rejects for greater profit for you. Eagle builds a timer for every timing problem.

Automation

STARTS WITH

EAGLE *Timers*

FOR ANY SIZE INDUSTRY

Send for FREE Automation Booklet "See what timing can do for you?"

Industrial Timers by **EAGLE**

EAGLE SIGNAL
CORPORATION
MOLINE, ILL.

For more information circle **69** on inquiry card.

plugging switch; carries a higher rating (10 amps at 125 v.ac.; 5 amps. 250 v.ac.). It indicates shaft rotation: snap-action contacts make (or break) as soon as shaft speed, on acceleration, reaches 20 rpm. Contacts remain actuated up to 500 rpm. and, on decreasing speed, return to static position at approximately 12 rpm.—*Winterburn Mfg. Co., Putnam, Conn.*

For more information circle **471** on inquiry card.

Electric Braking Systems

New "Zero-Plugging Control Systems" are for ultra-fast stopping of electric-motor-driven equipment. In contrast to electromechanical brakes, zero-plugging is a wholly electrical means of developing braking. It is applicable to any reversible motor and is said to be of importance to users as well as manufacturers of equipment. To users, addition of this system to control circuitry of a motor adds a low-cost maintenance-free braking feature to machine. Unlike conventional zero-plugging switches and devices, new systems are completely interlocked systems not requiring addition to relay elements to tie them into motor's starter; new switch design eliminates spurious response to vibration, and gives a range of "zero-speeds" from zero to motor's full-load speed.—*Techniflex Corp., Port Jervis, N. Y.*

For more information circle **472** on inquiry card.

TIME and COUNT

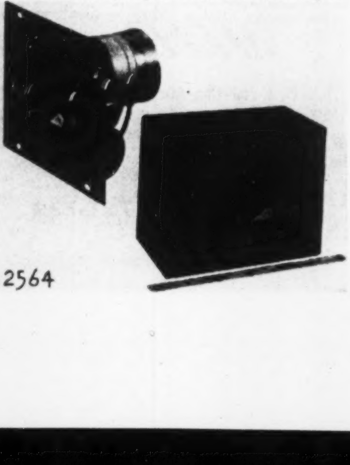
Time-delay Relays

New time delay relays utilizing *RC* principle are suitable for airborne applications where thermal type timers lack desired reliability, short reset time, and resistance to vibration. Dimensions 1⅝ x 1-7/16 x 2¼ in.; weight 6½ oz. Sealed enclosures filled with inert gas. Operating range 18 to 30 v.dc.; 5-amp. resistive load contact rating; long life (500,000 cycles minimum). Factory-set timing period from 0.015 to 0.5 sec. Various bases, including miniature tube plug-in and solder terminals.—*Contract Div., Electronic Specialty Co.,* 3456 *Glendale Blvd., Los Angeles* 39, *Calif.*

For more information circle **473** on inquiry card.

Automatic-reset Timer

New "Model 615-3" automatic reset short-interval timer complements maker's line of "Model 437" interval timers; is driven by a synchronous motor; holds a circuit open or closed, as spec-

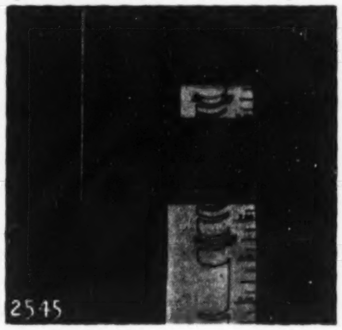


ified, for preset time after actuation by a momentary-contact switch (customer-furnished) placed at any desired location.—*Masco Products Co., 2119 Sepulveda Blvd, Los Angeles 25, Calif.*

For more information circle **474** on inquiry card.

Time Recorder and Totalizer

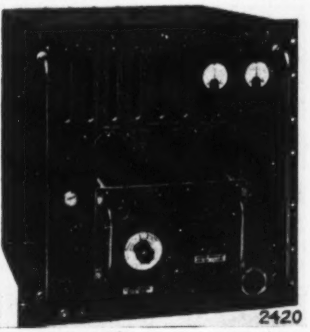
New "Time-Recorder-Totalizer" and "Time-Totalizer" simplify checking of processes and personnel. A continuous tape record shows when the process or equipment is on or off. One roll of tape will last almost a year. Time totalizer serves to determine when system and its components need cleaning, repair, or replacement.—*Heat-Timer Corp., 657 Broadway, New York 12, N. Y.*


2545

For more information circle **475** on inquiry card.

Time and Frequency Counter

New "Model 524B" is a new type of direct-reading automatic electronic counter that measures frequency from 10 cps. to 220 Mc., time interval from 1 microsecond to 100 days, and period from zero to 10 kc. Basic range of counter unit itself is 10 cps. to 10 Mc. for frequency counting or zero to 10 kc. for period measurement. Plug-in units: "Model 525A Frequency Converter" extends range to 100 Mc.; "Model 525B Frequency Converter," 100 to 200 Mc.; "Model 526A Video Amplifier" increases sensitivity to 10 mv.; and "Model 526B Time Interval Unit" measures intervals from 1 usec. to 100 days with accuracy of 0.1 usec. plus or minus 0.001 percent.—*Dep't P, Hewlett-Packard Co., 395 Page Mill Rd, Palo Alto, Calif.*


2420

For more information circle **476** on inquiry card.

High-speed Electric Counter

New "Electro-magnetic Impulse Counter" has dynamically balanced mechanism which prevents miscounts

---

SHOW TEMPERATURE AT THE CONTROL PANEL

WARN OF TROUBLE WHEN IT STARTS — USE SIMPLYTROL INDICATING PYROMETERS.

4½" Cat. #4511
3¾" Cat. #1654
2½" Cat. #2613

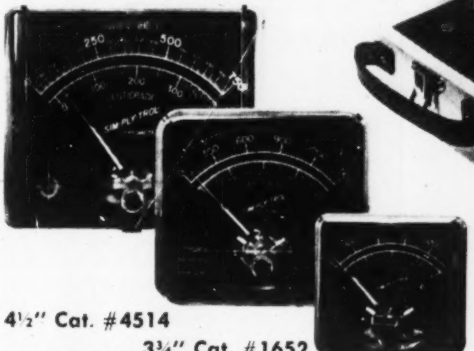
WHITE FACE

Medium resistance pyrometers (4 ohms per millivolt). Automatic, bimetal cold junction correction. Compensated for copper error. With adjusting resistor to take thermocouples up to external resistance shown in table. When specified will be adjusted for mounting in steel panel. Accuracy 2%.

Contact pyrometers have same size and appearance but include contacts, adjustable to close at any place on the scale arc. Ask for Bulletin G-5.

Model B

Model C



4½" Cat. #4514
3¾" Cat. #1652
2½" Cat. #2612

BLACK FACE

PORTABLES

Any of these pyrometers can be supplied in the Model B carrying case or in the Model C bench stand. Ask for Bulletin G-3.

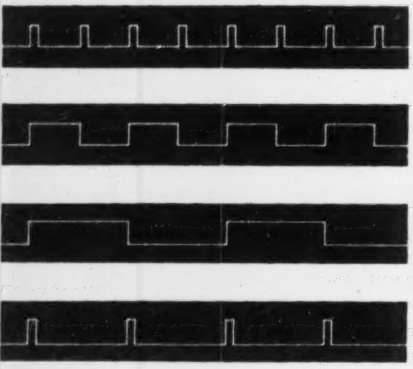
Temperature Range Degrees		Int. Res.	Ext. Res.	Thermo-couple	2½ inch Size 261 Cat. No.	Price	3¾ inch Size 351 Cat. No.	Price	4½ inch Size 451 Cat. No.	Price
0–3000° F	0–1650° C	70	10	Pt13%Rh	2618	$19.90	1658	$22.75	4518	$30.25
0–2500	0–1370	212	10	C/A	2611	18.40	1651	21.25	4511	28.75
0–2000	0–1100	172	10	C/A	2616	18.40	1656	21.25	4516	28.75
0–1500	0– 800	179	10	I/C	2612	18.40	1652	21.25	4512	28.75
0–1000	0– 500	112	10	I/C	2615	19.50	1655	21.80	4515	29.90
0– 750	0– 400	81	10	I/C	2614	19.50	1654	22.45	4514	31.05
0– 500	0– 260	52	8	I/C	2613	20.10	1653	23.00	4513	32.20
– 75 to 225	– 60 to 110	30	5	I/C	2617	23.00	1657	26.50	4517	35.65
–200 to 100	–130 to 40	30	5	C/C	2619	29.00	1659	32.50	4519	41.65

Several intermediate ranges not listed.

Thermocouples:—(not included). Chromel-alumel (C/A) 14 ga. insulated 5′ leads $4.00. Iron-constantan (I/C) or copper-constantan (C/C) 20 ga. insulated 5′ leads $2.90.

ASSEMBLY PRODUCTS, INC., P. O. BOX 191, CHAGRIN FALLS, 10, OHIO

For more information circle **70** on inquiry card.



Burroughs **PULSE** equipment lets you assemble your own system— **IN MINUTES**

Just by connecting standard cables between Burroughs Pulse Control units, you can assemble virtually any pulse system you want.

Suppose you need a complex pulse sequence for testing. The basic units required to make up the system can be ordered from Burroughs—and delivered from stock. Connect them together, and there's your system. You've saved time-consuming "breadboard" engineering, equipment cost, and delay on your primary project. What's more, your Burroughs Pulse Equipment can be used over and over again on different, future projects.

To meet the growing need for versatile pulse control systems, Burroughs offers a whole family of matched pulse handling units: pulse generators, coincidence detectors, flip-flops, gating circuits, etc. During the past four years, this equipment has been in use by such prominent organizations as MIT, Consolidated Engineering Corp., Wayne University, Stanford Research Institute, and many others.

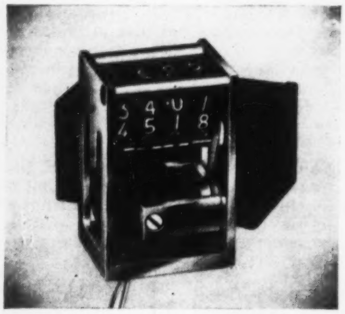
Let us help you get started quicker on pending engineering work. Write us a letter outlining briefly your pulse system requirements. Dept. 5-H, Electronic Instruments Division, Burroughs Corp., 1209 Vine St., Philadelphia 7, Pa.

ELECTRONIC INSTRUMENTS DIVISION

Burroughs

FIRST IN PULSE HANDLING EQUIPMENT

For more information circle **71** on inquiry card.



due to shock or vibration, thus suiting it to use in aircraft. Maximum speed 40 counts per second on actuation by interruption of a 28-v.dc. circuit.—*Unimax Switch Div., The W. L. Maxson Corp., 460 W. 34th St., New York 1, N. Y.*

For more information circle **477** on inquiry card.

Dual Bank Counter for Plus and Minus Indication

New high-speed dual-bank counter, originally for a navigating instrument, is suitable for directional indicators and computers. Shutter operates to close off either bank when it is in minus side of its reading. Unit wheels of each counter row have 50 increments to provide exceptional accuracy.—*Durant Mfg. Co., 1981 N. Buffum St., Milwaukee 1, Wis.*

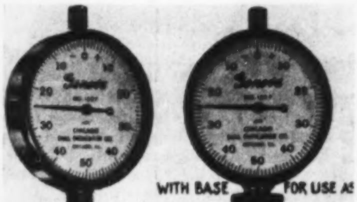
2392

For more information circle **478** on inquiry card.

DIMENSIONAL

Threaded-stem Indicator

New "Geneva Dial Indicator" with threaded stem eliminates unwieldy clamping to machines; overcomes problem of binding indicator spindle; provides a compact way of mounting on special bases.—*Dep't AC, Chicago Dial Indicator Co., 180 N. Wacker Drive, Chicago, Ill.*



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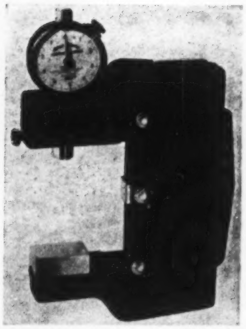
For more information circle **479** on inquiry card.

Adjustable Snap Gage

New "Model B-1200" adjustable snap gage, 0-to-3-in. capacity, has 0.0005-in. indicator (Federal or equiv-



alent), is available as shown or with attachments and case as "B-1200A Snap Gage Set." Attachments include locating contacts, top and bottom groove contacts, 12-in. extension bar, etc.—*Reliant Industries, 4947 Firestone Blvd, South Gate, Calif.*

For more information circle **480** on inquiry card.

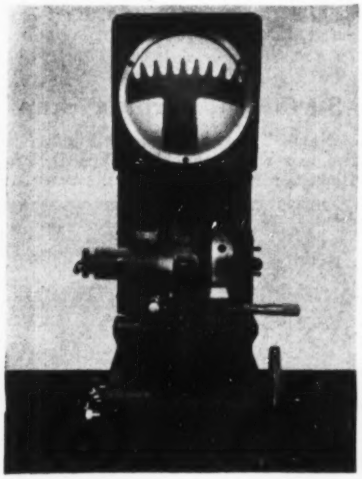
Cesium Beta Gage

New "BG-5 Light Materials Gauge" utilizes a radioactive source of cesium-137 (an isotope not hitherto used for gaging) which emits low-energy beta rays (ideal for gaging light materials) and which has a long half-life (33 years). Its 2 mg./cm.^{2} full-scale sensitivity is equivalent to a thickness change of 0.001 in. of a plastic film such as Saran. It may be obtained with "C" frames of various throat depths, and with "all-angle" scanning mounts.—*Tracerlab Inc.,* 130 *High St., Boston* 10, *Mass.*

For more information circle **481** on inquiry card.

Optical Comparator

New "Model 67 Projector," embodying vertical or horizontal lens systems, or both, in combination with contour



If you must control temperature in any of these operations . . .

Storage water heaters
Metal plating tanks
Bottle washers
Treaters
Slashers
Fuel oil preheaters
Petroleum heaters and treaters
Chemical heaters
Engine and compressor cooling
Industrial processing

You'll control it more accurately and at lower cost with SYLPHON REGULATORS

No. 999 Has large-size, 2-ply Sylphon bellows for added power. Over-temperature protection.

No. 926 Safety Type. Has "Fail-Safe" feature.

TYPICAL FULTON SYLPHON TEMPERATURE REGULATORS

No. 998 Series Recommended where a wide range of temperature adjustment is required. Over-temperature protection.

No. 923-Q Equipped with crank to give quick change in temperature setting.

SEE OUR LATEST DEVELOPMENTS AT THE INSTRUMENT SHOW BOOTHS 726, 728, 730

Whether you are dealing with liquids or gases, there's a Sylphon Regulator to give you accurate temperature control. The design and construction of these controls is so simple that costs are low . . . low enough to warrant wide-spread use within your plant.

There's no need for dangerous and inaccurate methods of checking temperature. Sylphon Regulators eliminate personal danger and "guesswork". Some can be equipped with dial indicating thermometers, such as No. 999-T. "Fail-safe" feature is incorporated in No. 926. *All* save fuel and process time.

For complete information on any of the controls shown here . . . or on the complete Fulton Sylphon line, write Dept. P E-D, Robertshaw-Fulton Controls Company, Fulton Sylphon Division, Knoxville 1, Tennessee.

Robertshaw-Fulton
CONTROLS COMPANY

FULTON SYLPHON DIVISION • KNOXVILLE 1, TENN.

For more information circle **72** on inquiry card.

PALMER

A great name in thermometers

will introduce at the

FIRST INTERNATIONAL INSTRUMENT CONGRESS AND EXPOSITION

September 15-21st

an outstanding improvement in mercury actuated Dial Thermometers

Booth 747-749

●

If you are unable to attend the show, write for Bulletin #350, describing in detail this new and efficient instrument.

PALMER
THERMOMETERS, INC.
Norwood Ave. Cincinnati 12, Ohio
Mfrs. of Industrial Laboratory
Recording and Dial Thermometers

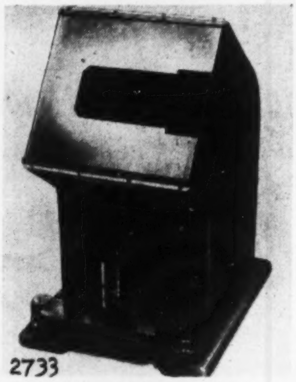
For more information circle **73** on inquiry card.

or front surface projection, has 7-in. screen; is said to be "the most versatile offered by an American manufacturer." Micrometer measuring stage attaches to table. Customer choice of opaque screen in light-tight hood, or ground glass screen to use with overlay charts. Comes completely wired, enabling user to attach additional light sources, or lens systems.—*Stocker & Yale Inc., Marblehead, Mass.*

For more information circle **482** on inquiry card.

Optical Comparator

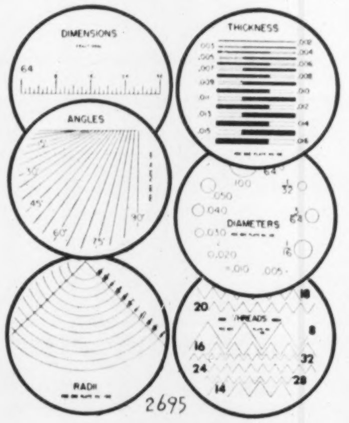
New "Model C Small Parts Comparator" is said to be of an entirely new design, for 100-percent optical production inspection, against an enlarged drawing, of small odd-shaped parts. Among features: many parts can be laid flat on stage without holding fixtures; screen and stage in line with operator's hand and vision; light source causes no discomfort or interference; erect and unreversed image which also permits instrument to be used for delicate assembly.—*George Scherr Optical Tools Inc.,* 200 *Lafayette St., New York* 12, *N. Y.*


2733

For more information circle **483** on inquiry card.

Pocket Comparator

New "Pee Gee" pocket comparator features 6-power lens and reticles which are reductions of master layouts: "Scales" reticle (not shown) has 0.0025-in. and 0.2-mm. graduations; six others are shown.—*National Tool Co.,* 11200 *Madison Ave., Cleveland, Ohio.*

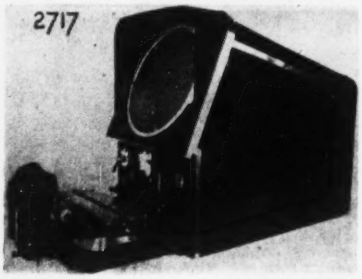


2695

For more information circle **484** on inquiry card.

Optical Comparator

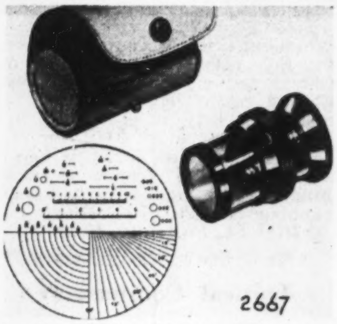
New "Model L-400" horizontal (bench type) optical comparator features an exceptionally large work area: plain work stage on standard model is 18 in. long, full 6-in. work space from lens system center line to stage top. A completely universal (coordinate type) measuring stage, also available, as are: precision vertical and longitudinal measuring units, graduated rotary screen with vernier scale, overlay chart holder, heavy cabinet type base, and new spring plunger "V" type center stage.—*Portman Instrument Co., Town Dock Rd, New Rochelle, N. Y.*


2717

For more information circle **485** on inquiry card.

Pocket Comparator

New "Indeco" pocket comparator, 1½-in. diam., has six-power magnifying lens, measures angles, small diameters and radii, microscopic lengths, or tool wear, chamfer angles, small part tolerances, etc., without re-focusing. Comparator is placed in contact with part to be measured and dimension is lined up with reticle for immediate check.—*International Development Co.,* 1 *S. Reed St., East Riverton, N. J.*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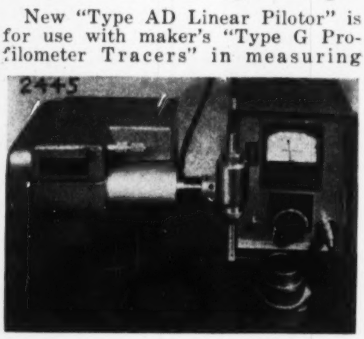
For more information circle **486** on inquiry card.

Surface-measuring Pickup

New "Type AD Linear Pilotor" is for use with maker's "Type G Profilometer Tracers" in measuring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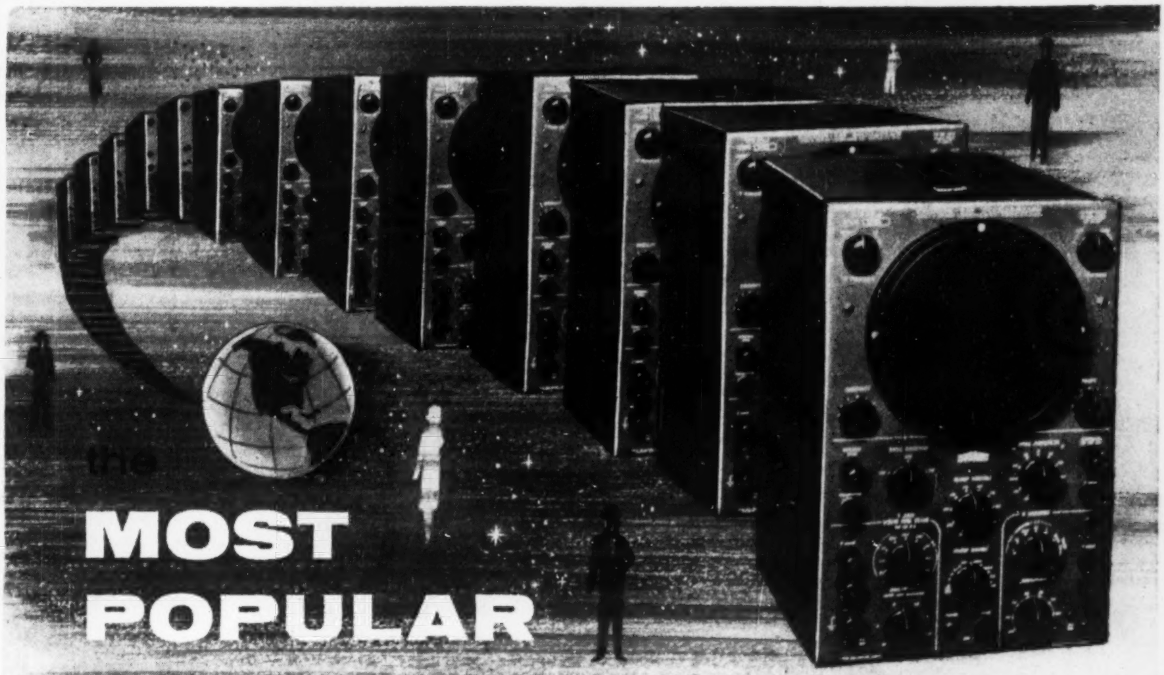


the MOST POPULAR OSCILLOGRAPH EVER MADE

type 304-A

Superlative performance and almost legendary dependability have won for the Type 304-A the envied position of the most popular oscillograph ever produced. With the possible exceptions of its honored predecessors, the Types 304-H, 304, and 208, no other oscillograph has found such immediate acceptance, nor is used so broadly in all phases of science and industry. *More Type 304-A's are in use—in laboratories, in service shops and on production lines—than any other cathode-ray oscillograph.*

The reason for this world-wide popularity? The accompanying list of features will tell you. No other instrument can provide such versatile, dependable performance at such a low price.

- **HIGH SENSITIVITY** – Deflection factor of 100 p-p mv full scale (equivalent of 25 p-p mv per inch) provides useful deflection from almost every signal encountered in general laboratory work, without need for preamplification.
- **DIRECT VOLTAGE MEASUREMENTS** – Push-button calibration enables accurate amplitude measurement of any portion of input signal directly in volts from the scale.
- **FLAT-FACE TIGHT-TOLERANCE CATHODE-RAY TUBE**–Precision built Du Mont Type 5ADP Cathode-ray Tube assures faithful display and minimizes parallactic errors.
- **HIGH ACCELERATING POTENTIAL** – Overall acceleration of 3000 volts assures brilliant trace with excellent spot size, and provides maximum efficiency of long-persistence screens.
- **D-C OR A-C AMPLIFICATION** – Vertical frequency response is flat from d-c to 10% down at 100,000 cps and 15% down at 30,000 cps *with no possible slope.*
- **DRIVEN AND RECURRENT SWEEPS** – Variable in frequency from 2 to 30,000 cps
- **SWEEP EXPANSION** – Up to 6 times full screen diameter for study of high frequency components or low frequency signals.
- **EXTRA-LOW-FREQUENCY SWEEPS** – By addition externally of high quality capacitors very slow sweeps may be generated for the display of long-duration functions.
- **STABILIZED SYNCHRONIZATION** – For stable presentations without horizontal jitter and for reliable driven-sweep operation; Sync limiting on both driven and recurrent sweeps eliminates possibility of pattern distortion owing to "over-syncing".

PRICE $375

FOR FULL SPECIFICATIONS WRITE
THE ***TECHNICAL SALES DEPARTMENT***
AT THE ADDRESS BELOW.

DU MONT

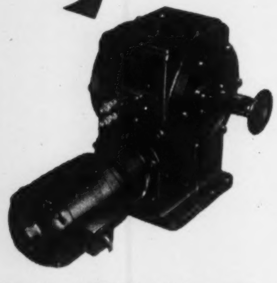
Allen B. Du Mont Laboratories, Inc.
760 Bloomfield Ave., Clifton, N. J.

See the Du Mont exhibit at Booth 536-537 at the WESCON show.

For more information circle **74** on inquiry card.

A portion of the 200 acre scale model of the Mississippi Basin, shows one of the Askania Controls used in this flood control study.

Huge 200 acre experiment needs PRECISE CONTROL!



The Askania Unit Regulator, a completely self-contained automatic control. This versatile unit, one of an extensive line, finds its widest use in applications where measured signals are low level and power requirements at the point of control are moderate.

"See us at Booth Nos. 601-603, First International Instrument Congress & Exposition, September 13-24, 1954"

The Corps of Engineers, U. S. Army uses a 200 acre scale model of the Mississippi Basin in flood control studies that may eventually solve that area's flood control problem. In the studies, six standard Askania Controllers were used to assist in precisely simulating the behavior of one of the world's mightiest river systems.

While flood control may not be your problem, precise, sensitive, and powerful Askania controls may be the solution to your control problems. These units are currently solving problems in the metal, glass, plastic, rubber, textile and paper processing industries. If you have control problems that are boosting your costs or lowering your product quality, investigate these Askania Controllers.

Write for Bulletins 139 and 155.

ASKANIA REGULATOR COMPANY
287 E. Ontario Street, Chicago 11, Illinois
Subsidiary of General Precision Equipment Corp.

For more information circle **75** on inquiry card.

roughness of short or hard-to-reach surfaces. It provides a vibrationless straightline tracing movement of any desired length from 1/32 in. to 1¼ in., with smooth and rapid reversals.—*Micrometrical Mfg. Co.,* 345 *S. Main St., Ann Arbor, Mich.*

For more information circle **487** on inquiry card.

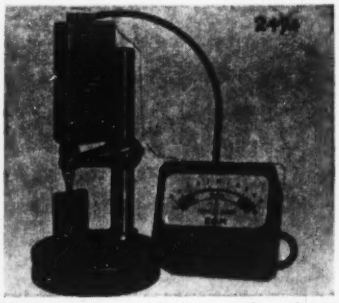
Micrometer Comparator

New "Model 2" measures to a microinch without physical contact with workpiece; requires no external power supply stage or amplifier; generates 1 microamp. per microinch by using "an entirely new principle of measurement."—*Decker Aviation Corp.,* 1361 *Frankford Ave., Philadelphia* 25, *Pa.*

For more information circle **488** on inquiry card.

Micrometer Comparator

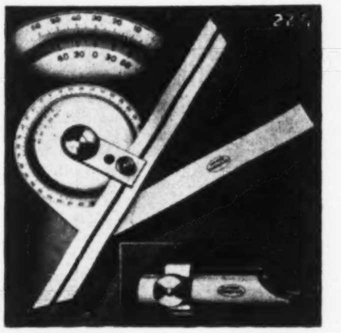
New "Electronic Auto-sizer," capable of one micron tolerance, withstands rough handling; is self-compensating for temperature and moisture changes, wear, etc. Test reports indicate millionth piece identical to first within guaranteed tolerance of one micron. Measuring head maintains capacitance linearity over a wide range; directly translated from displacement of gage feeler due to diminishing size of workpiece. When pre-adjusted bridge zero point is reached, relays respond instantaneously. Plug-in components are available for different phases or steps. Measuring heads can be supplied interchangeably for external or internal cutting, grinding, etc.—*Electro-Autosizing Machine Co.,* 535 *Fifth Ave., New York* 17, *N. Y.*



For more information circle **489** on inquiry card.

Bevel Protractor

New "Universal Vernier Bevel Protractor" features "Lustro-Chrome" finish over entire measuring dial.



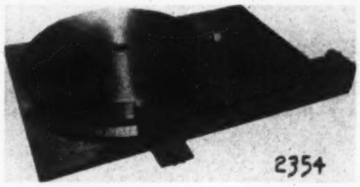
Vernier permits any angle to be measured to 5 minutes.—*George Scherr Co., 200 Lafayette St., New York 12, N. Y.*

For more information circle **490** on inquiry card.

MACHINE AUTOMATION

Index Table

New "Model 48" outside turning and locking index table is unique in that adjustments can be made or working parts removed without disturbing table or disassembling tooling. Table in photo is 48 in. diam.; has six stations and is designed for hydraulic operation. This model is available, however, in sizes from 20 in. to 48 in. diam., with 6 or more stations, for either air or hydraulic operation.—*Air-Hydraulics, Inc., 222 Belden Road, Jackson, Mich.*



For more information circle **491** on inquiry card.

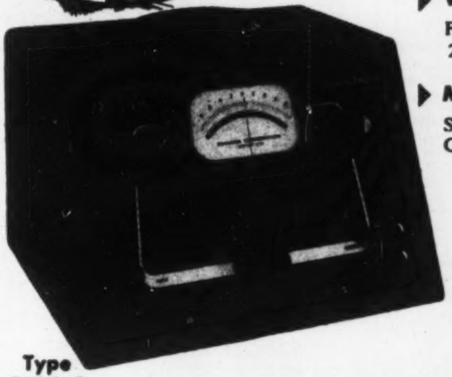
Indexing Unit

New cam-operated indexing unit provides precision positioning between automatic production stations, or simplified means of timing production-operation drives. Increments of 8, 12, 16 or 20 can be obtained during cycle. Worm-and-gear connections to input shaft drive cylindrical cam which provides motion to indexing table. Cam-

a UNIQUE application . . . of a NEW principle for a BETTER instrument

Doelcam

D-C Indicating Amplifier



Type 2HLA-3

- **High Stability**
  Less than 10 microvolts long term drift
- **Wide Dynamic Response**
  Flat from 0 to greater than 20 cps
- **Magnetic Input**
  Second-Harmonic Magnetic Converter for input stage

Linearity within 1%

High input impedance

Zero-center meter

Will drive recorders

Write for Bulletin 1A-4

THE DOELCAM D-C Indicating Amplifier is a completely self-contained instrument for the amplification and measurement of d-c voltages and currents of minute magnitude. A new design concept employing the remarkable sensitivity and inherent stability of the second harmonic magnetic converter is used in the input stage of the amplifier. This design feature, by eliminating all moving parts such as mechanical choppers, makes this instrument ideally suited for applications where accuracy, reliability and insensitivity to changing ambient conditions are of prime importance.

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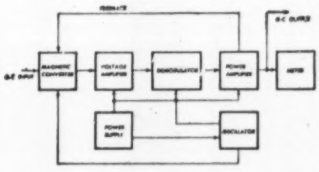
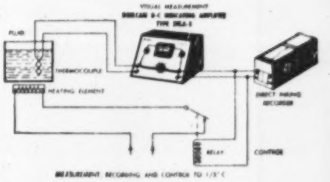
SOLDIERS FIELD ROAD, BOSTON 35, MASS.
West Coast Office: 304 Tejon Pl., Palos Verdes, Calif.
Instruments for Measurement and Control
Synchros • Gyros • Servos • Microsyns • Servo Motors


FEEDBACK
D-C INPUT
MAGNETIC CONVERTER
VOLTAGE AMPLIFIER
DEMODULATOR
POWER AMPLIFIER
D-C OUTPUT
METER
POWER SUPPLY
OSCILLATOR

MAGNETIC INPUT . . . Block Diagram showing DOELCAM Second Harmonic Magnetic Converter as input stage . . . a new design concept


VISUAL MEASUREMENT
DOELCAM D-C INDICATING AMPLIFIER
TYPE 2HLA-3
FLUID
THERMOCOUPLE
HEATING ELEMENT
DIRECT INKING RECORDER
RELAY
CONTROL
MEASUREMENT, RECORDING AND CONTROL TO 1/5° C

MEASUREMENT - RECORDING - CONTROL to 1/5° C. A typical Process Control application showing high accuracy of DOELCAM Type 2HLA-3

For more information circle **76** on inquiry card.

VISIT BOOTH 406
AT PHILADELPHIA ISA SHOW
FOR

STICHT

PRECISION INSTRUMENTS

MEGOHMER

INSULATION TESTERS
GENERATOR TYPES

"MINOR" Dwarf Size 3 lbs 500 Volts, 50 megohms, Bull. 450

"MAJOR" Small size constant pressure, 500 Volts, 50 megohms, Extra ohm scale, Bull. 465

"STANDARD" Heavy duty constant pressure 500 or 1000 Volt. Ranges to 2000 meg ohms, Bull. 455

BATTERY VIBRATOR TYPES

"MODEL B-7" Precision Ohmmeter - Megohmmeter. 2 megohm ranges, 2 ohm ranges, 2 test potentials. Bull. 440

"MODEL B-6" 4 instruments in 1. Ranges: 200 megohms, 2000 ohms, AC & DC volts up to 600 Bull. 441

ELECTRONIC TYPES

"MODEL 29A" Measure resistances from .3 to 20 million megohms. Test potentials 85V and 500V DC. Bull. 1029

"ENGLISH ELECTRIC TESTER" Adjustable test voltage from 500 to 10,000 volts DC. Range: 100-250,000 megohms, Bull. ES 106

TACHOMETERS

HAND TYPES
TYPE "U"
UNIVERSAL
CENTRIFUGAL TYPE
5 Ranges in 1 Instrument
Cat. No. 303 30-12,000 RPM
Cat. No. 314 45-18,000 RPM
Cat. No. 322 60-24,000 RPM
Cat. No. 346 120-48,000 RPM
Bulletin 750

"JAQUET"
SPEED INDICATORS
(CHRONOMETRIC)
Guaranteed Accuracy within ½ of 1%
Cat. No. 2301 0-10,000 RPM
Cat. No. 2302 0- 1,000 RPM
Suitable double rated speed.
8 models, various accessories.
Bulletin 735

STATIONARY TYPE
MODEL "J"
Sizes 3", 4", 5½", 8", 10", and 20" dial diameter, flexible shaft driven.
Many standard ranges reading RPM, FPM, YPM, etc.
Bulletins 795, 796, 797

HERMAN H. STICHT CO., INC.
27 PARK PLACE NEW YORK, N. Y.

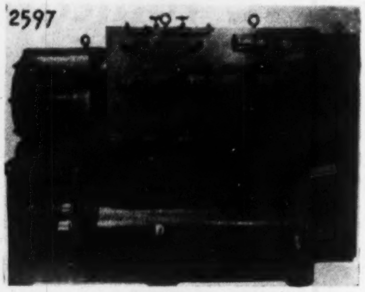
For more information circle **77** on inquiry card.

shaft extensions permit operating auxiliary drives, etc. Dimensions: 17 by 16½ by 13¾ in.—*Standard Tool & Mfg. Co., 740 Schuyler Ave., Lyndhurst, N. J.*

For more information circle **492** on inquiry card.

Hydraulic Power Units

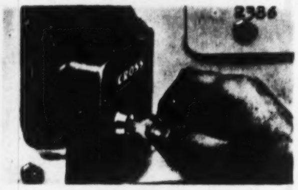
New hydraulic power units are available in standard, JIC and custom-built designs for operating pressures from 250 to 2000 psi. Pictured is a typical "package" unit which includes all necessary motors, pumps, controls, valves, piping oil reservoir; also essential hydraulic accessories such as oil level gages, filters, cleaners, fittings, etc.—*Turchan Follower Machine Co., 8259 Livernois, Detroit 4, Mich.*



For more information circle **493** on inquiry card.

Machine-tool Hydraulic-feed Control Lock

New "Cross Flow Control Lock" prevents unauthorized personnel from tampering with hydraulic feed setting on production machine tools; assures maintenance of correct feed rates, protects machine from avoidable abuse. —*Dep't 59P, The Cross Co., Detroit 7, Mich.*



For more information circle **494** on inquiry card.

SHOP EQUIPMENT

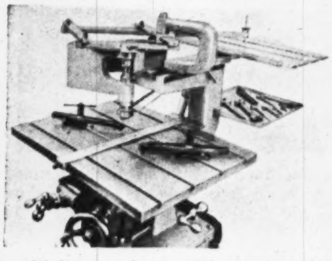
Desk Lathe

New "Desk Model," added to maker's "Standard" line, has desk-high bed and spindle for convenience of women operators; operating lever and pedals placed for fast and easy action; also instant spindle run-stop and collet position control; 7-in. swing, 15 in. between centers, speeds to 4,000 rpm.; may be equipped with compound slide rest, double cross slide, 6-hole turret, etc.—*Dep't O, Elgin Tool Works, Inc., 1770 Berteau Ave., Chicago 13, Ill.*

For more information circle **495** on inquiry card.

Engraving-machine Worktable

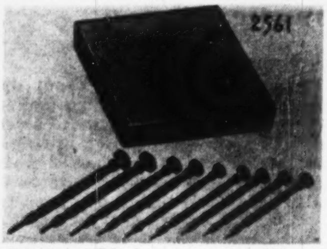
New "Extra Large" worktable for attaching to maker's "Model 2D-4" engraving machine is 18x24 in. and 1 in. thick; can be readily mounted on top of existing worktable; can also be used, by attachment in same manner, with other engraving machines; is advantageous when engraving panels, instruction boards, etc.—*H. P. Preis Engraving Machine Co., 661 U. S. H'way 22, Hillside, N. J.*



For more information circle **496** on inquiry card.

Small Screw Drivers

New screw drivers for fine watch work or instrument work are available in nine blade sizes from 0.016 in. to 0.094 in. Blades are reversible and replacements may be purchased separately.—*Louis Levin & Son, Inc., 3610 So. Broadway, Los Angeles 7, Calif.*

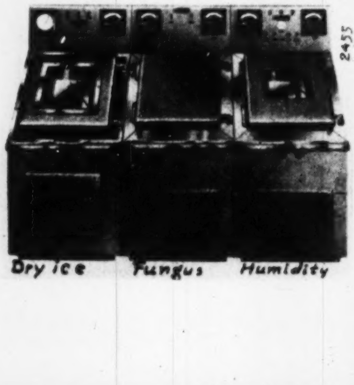


For more information circle **497** on inquiry card.

MECHANICAL TESTING AND INSPECTION

Environmental Test Cabinets

New line of environmental test cabinets feature sloping-front design said to maintain more uniform test conditions while permitting faster



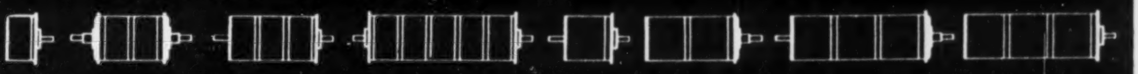
BORG MICROPOTS

the NEW STANDARD of precision multi-turn potentiometers

BORG 900 SERIES 3-TURN AND 10-TURN MICROPOTS

3-TURN MODELS 931-935

10-TURN MODELS 901-903



[illegible] 900 Series Micropots [illegible] that they meet special design [illegible] has created a new standard for high [illegible] potentiometers. [illegible] of the Borg 900 Series include greater [illegible] torque, longer [illegible] vibration, greater adaptability and versatility of application.

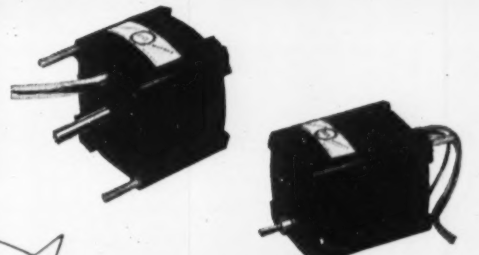
Standard models include [illegible] precision Micropots in 1 to 3 gang models, [illegible] models, single or double shafts, servo or bushing mounts on either or both ends. Available to [illegible] engineers in any quantity.

SYNCHRONOUS AND INDUCTION BORG-MOTORS

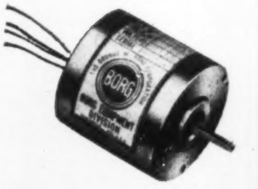
1000 SERIES 2 POLE AND 4 POLE MODELS

With and Without Gear Trains

These Borg-Motors were designed specifically for instrumentation, control and timing devices. They are recommended for all applications where low torque, constant speed and long life are positive requirements.



For Complete Engineering Data



SERVO-CONTROL

Borg-Motors

Two phase, 115 volt, 400 cps induction type Borg-Motors for servo control applications. Approximate size 1½" diameter x 2" long with a locked rotor torque of 0.82 ounce-inch.

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TITLE...

Please send complete information and engineering data on items checked.

- ☐ Precision Multi-Turn Potentiometers, 900 Series
- ☐ Borg Standard Potentiometer, 1100 Series
- ☐ Precision Multi-Turn Counting Dials
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For more information circle **78** on inquiry card.

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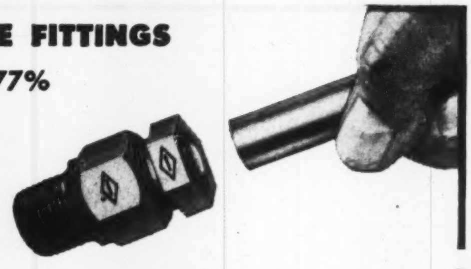
FASTER AND MORE ECONOMICALLY.

for Metal Tubing

IMPERIAL *Hi-Duty*® TUBE FITTINGS

Reduce Installation Time 36 to 77%

To make a joint you simply push tube into HI-DUTY FITTING and tighten nut. This enables you to save up to 77% in installation time. Nut and sleeve are one piece. Sleeve shears off and becomes attached to tubing in assembly, assuring perfect sleeve alignment. For tubing 1/8" to 1" O.D. Ask for Bulletin No. 3002-A.

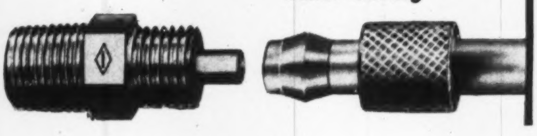


for Plastic Tubing

IMPERIAL *Poly-Flo* TUBE FITTINGS and Polyethylene Tubing

Simplify Installation . . . Make Possible Tremendous Labor Saving

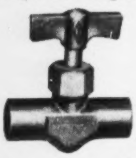
Ease of assembly and installation make Poly-Flo Fitting and plastic tubing ideal for instrumentation, panel boards, laboratory equipment, etc. Fittings need only be finger tightened. Tubing is flexible and bends readily by hand. Fittings and tubing furnished in 1/4", 5/16" and 3/8" O.D. sizes. Ask for Bulletin No. 3025.



for Valving

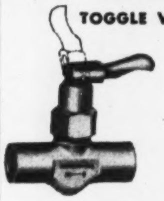
IMPERIAL FLUID CONTROL VALVES

NEEDLE VALVES
Straight and Angle Types



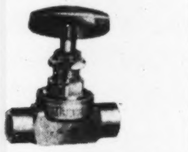
Designed for maximum dependability; easy operation.

TOGGLE VALVES



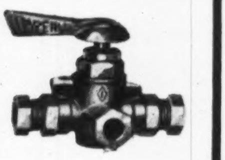
Quick operating; shows at a glance whether open or closed.

PACKLESS DIAPHRAGM VALVES



For positive control of pressure and vacuum. Solid Teflon diaphragm.

HI-DUTY VALVES



Plug Type. 2, 3 and 4-way styles.

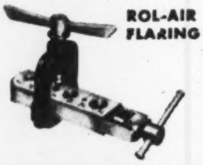
for Tubing Work

IMPERIAL TUBING TOOLS

HI-DUTY TUBE CUTTER

Free wheeling ball bearing action. Roller type with flare cut-off groove. Retractable reamer. **No. 274-F** for 1/8" to 1" O.D. hard or soft tubing.

ROL-AIR FLARING TOOLS



Flares and then automatically burnishes flares. Makes stronger flares, assures tighter joints. **No. 507-F** for 37° flares. Flares 3/16", 1/4", 5/16", 3/8", 1/2", and 5/8" O.D. tubing. **No. 500-F** for 45° flares.

BLUE DOT TUBE BENDERS

Bend hard or soft tubing. Form neat accurate bends to short radius. Calibrated. **No. 364-F.** Individual benders for each size of tubing 3/16" to 3/4" O.D. Also many other tools.

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IMPERIAL

Pioneers In Tube Fittings and Tube Working Tools

For more information circle **79** on inquiry card.

loading and unloading as well as easier viewing; come ready to plug into 110-v. outlet. Models illustrated have stainless steel test spaces of 2 cu. ft.—*Murphy & Miller*, 1322 *So. Michigan Avenue, Chicago, Ill.*

For more information circle **498** on inquiry card.

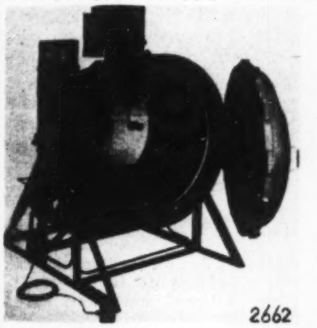
Temperature-test Chamber

New "A-120-1" 1-cu. ft. test unit, is mainly for low-temperature testing, but addition of an explosion-proof 500-watt heater extends temperature range of basic unit from -120 F. to 200 F. Available test accessories include an air circulator in lid for rapid cooling or heating; observation windows in lid and front; interior lights; entrance holes; terminal pad with up to 24 terminals inside and outside cabinet; and instrumentation as required including indicating or recording controller. Unit is 43 in. high, 20 in. long and 18 in. wide, weighs approx. 500 lbs.—*Cincinnati Sub-Zero Products*, 3930 *Reading Rd, Cincinnati* 29, *Ohio.*

For more information circle **499** on inquiry card.

Explosion Test Chamber

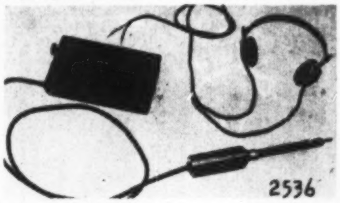
New "Model VX35," 35 cu. ft. internal volume, is self-contained with vacuum pump, fuel supply and metering system. Has "Harris" quick opening door (3 seconds), remote firing button, hydraulic and electrical accessory ports.—*Hiatt Engineering Co.*, 2228 *N. Hollywood Way, Burbank, Calif.*



For more information circle **500** on inquiry card.

Electric Sound Probe

New "Electronic Sound Probe" multiplies sound volume, transmits directly into earphones; enables users to diagnose and locate trouble spots in mechanical equipment: a tractor or a watch. Feature: natural reproduction of noise at source, no distortion, no foreign or built-up sounds.—*The Gel-Me Co., P.O. Box* 293, *Bloomington, Ill.*



For more information circle **501** on inquiry card.

Heat-freeze Test Chamber

New industrial test chamber can drop temperatures from 600 F. to -100 F. in less than two hours to test jet aircraft devices; can also be used for treatment or tempering of tool or special steels; in chemical, or petroleum or pharmaceutical analysis, etc. Temperatures can be held within 2 deg. or increased or decreased at any desired rate. Automatic controls can be provided for recurrent cycles.—*Conrad Inc., Holland, Mich.*

For more information circle **502** on inquiry card.

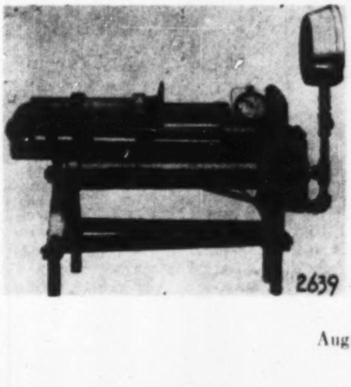
Fluoroscope

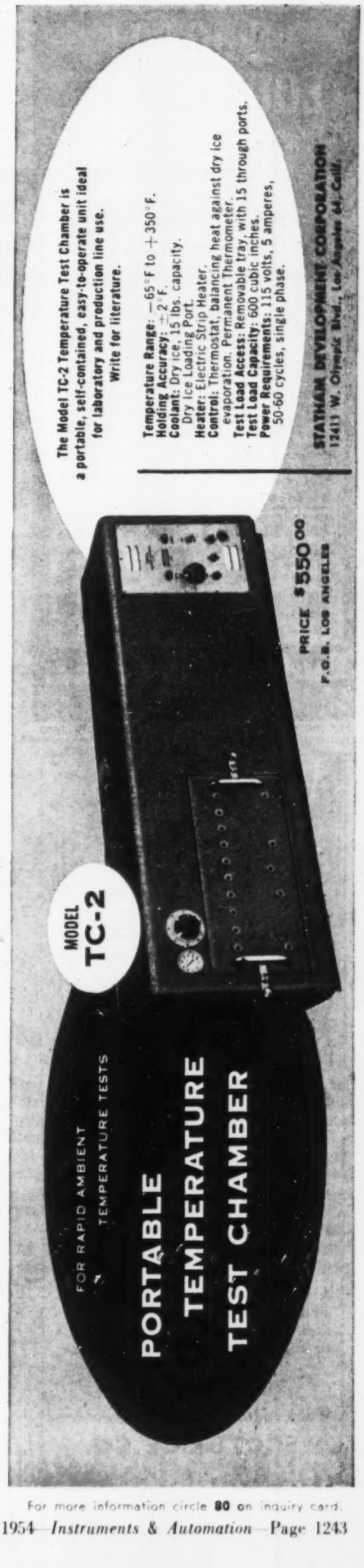
New "Adrian QC" (quality control) fluoroscope, for visual x-ray inspection of parts and materials, loads from front and can be supplied with a push button control for rapid opening and closing of hood. Screen size of standard model is 16 x 23 in. and inspection area is 18½ x 26 in. Class "A" cabinet affords complete operator protection.—*J. W. Dice Co., Englewood, N. J.*

For more information circle **503** on inquiry card.

Pressure Tester

New Experimental Tester, devised by technologists in canning industry, serves to determine amount of pack




PORTABLE TEMPERATURE TEST CHAMBER

FOR RAPID AMBIENT TEMPERATURE TESTS

MODEL TC-2

PRICE $550.00
F.O.B. LOS ANGELES

The Model TC-2 Temperature Test Chamber is a portable, self-contained, easy-to-operate unit ideal for laboratory and production line use.
Write for literature.

Temperature Range: −65°F to +350°F.
Holding Accuracy: ±2°F.
Coolant: Dry ice, 15 lbs. capacity.
Dry Ice Loading Port.
Heater: Electric Strip Heater.
Control: Thermostat, balancing heat against dry ice evaporation. Permanent Thermometer.
Test Load Access: Removable tray, with 15 through ports.
Test Load Capacity: 600 cubic inches.
Power Requirements: 115 volts, 5 amperes, 50-60 cycles, single phase.

STATHAM DEVELOPMENT CORPORATION
12411 W. Olympic Blvd., Los Angeles 64, Calif.

For more information circle **80** on inquiry card.

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For more information circle 81 on inquiry card.

CONFIDENTIAL MAP FILE

Easiest way to file and find maps, blue prints, tracings, etc. Metal cabinet file with locking doors. 112 tilting tubes handle 60" prints. Tubes are indexed for quick location.

Also available in entire fire-resistant safes, portion of safes and custom-built wood cabinets to match executive office decor.

Patent No. 1610368.
Other Pats. Pending.

Write today for illustrated folder.

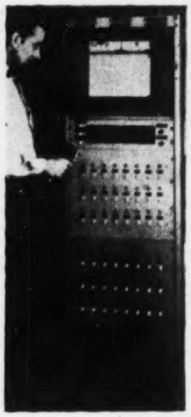
SCOTT-RICE CO.
608 S. Main Tulsa 3, Okla.

For more information circle 82 on inquiry card.

in typical cans where oil is employed as a filler, so that a standardized pack can be worked out.—*W. C. Dillon & Co., Inc., P.O. Box 3008, Van Nuys, Calif.*

For more information circle **504** on inquiry card.

Strain-gage Plotter



New "Model 114" of maker's "High Speed Strain Gage Autographic Plotter" embodies several new features and accessories, among them: (1) Auto-pilot lights for channel identification; (2) motor-driven zeroing gun for quickly setting zero balance position of each channel; (3) remote portable connection panels to reduce wiring-up time; (4) gage factor and range selection controls for individual or blocks of channels; (5) six new range scales from 1000 to 20,000 microinches full scale.—*Gilmore Industries, Inc.,* 5713 *Euclid Ave., Cleveland* 3, *Ohio.*

For more information circle **505** on inquiry card.

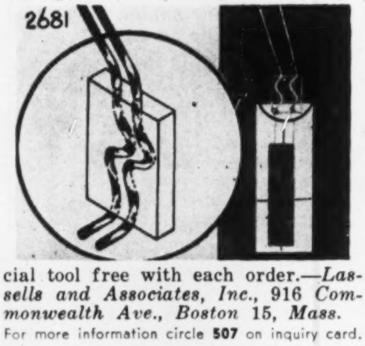
Multichannel Strain-gage Selector Switches

New "No. LA-S100" (100-point) and No. LA-S50" (50-point) have readily-accessible terminals which permit separate gage leads to be attached with ease. Change in contact resistance of any switch point averages 0.08 milliohm and does not exceed 0.48 milliohm.—*Lessells and Associates, Inc.,* 916 *Commonwealth Ave., Boston* 15, *Mass.*

For more information circle **506** on inquiry card.

Strain-gage Connectors

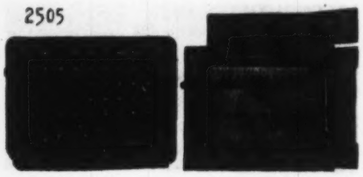
New connectors greatly increase ease and dependability of strain-gage wiring; come in packages of ten. Special tool free with each order.—*Lassells and Associates, Inc.,* 916 *Commonwealth Ave., Boston* 15, *Mass.*



For more information circle **507** on inquiry card.

Strain-gage Scanner-recorder

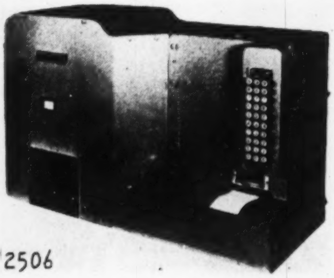
New "SR-4 50-Point Strain Scanner-Recorder" comprises a switching unit (left) and a scanning strip chart recorder (right) with auxiliary assembly on top containing measuring circuits and associated controls. It permits records from "SR-4" strain gages at 50 points to be taken automatically in 30 to 90 seconds. Recorder provides three ranges: 0-2000, 0-5000, and 0-10,000 microinches; can handle gages with mixed resistances from 60 to 500 ohms and with gage factors from 1.7 to 2.25.—*Baldwin-Lima-Hamilton Corp., Philadelphia* 42, *Pa.*



For more information circle **508** on inquiry card.

Digital Printer for Strain-gage Outputs

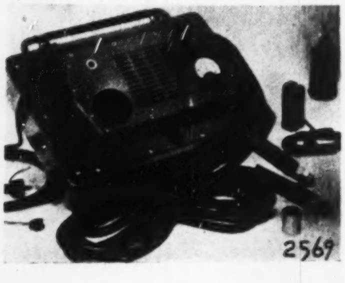
New "Type 8A SR-4 Digital Printer" takes signals from "SR-4" strain-gage devices used in measuring forces, pressures, and torques; prints three or four digits on continuous tape, tickets, or sheets up to 8½ x 11 in. with or without carbons. Printing can be manually actuated or automatic at a preset interval. Operation is by a self-balancing null-method electrical system. Standard response speed is 12 or 24 sec. (faster if specified). Identification keys optional. Time, day, month and year can also be printed, either manually or automatically. — *Baldwin-Lima-Hamilton Corp., Philadelphia* 42, *Pa.*



For more information circle **509** on inquiry card.

Portable Magnetic-particle Test Unit

New "Portaflux" weighs 45 lbs., is designed to locate surface defects in rough castings, bar stock, shop welds, pipelines, etc. Objects to be checked



OPTICAL-MECHANICAL MEASURING EQUIPMENT

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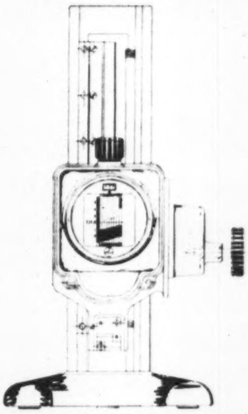
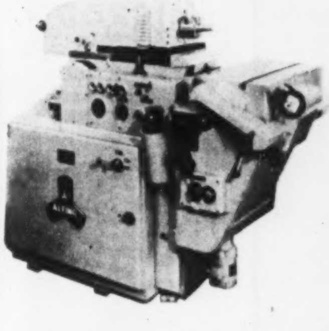
OPTI-HEIGHT GAGE

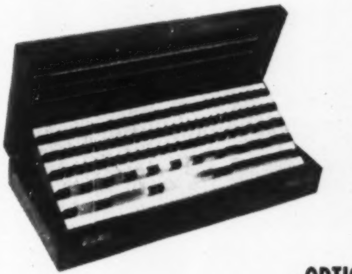


The Opti-Height Gage provides accurate measurement of height from a base surface, without use of gage blocks, by utilizing a precision scale and an optical arrangement. The Gage gives direct readings accurate to within 0.0001 inch for a full range of 0.500 to 12.500 inches. It is an optical gage, utilizing a glass scale for major divisions of 0.050 inch kept to a spacing tolerance 0 ± 0.00002 inch. These 0.050 scale divisions are projected to magnify the scale divisions 34 x.

JIGOMATIC

The Jigomatic is both a precision boring machine and a toolroom horizontal jigborer. The work table can be moved vertically and horizontally; it can be positioned accurately and easily with a new type of optical measuring system. Spindle speeds are infinitely variable and cover a range of 300 to 3000 R.P.M. Ideally suited for precision boring operations even when small quantities are involved, and for spotting and boring holes in drill jigs or on work pieces.

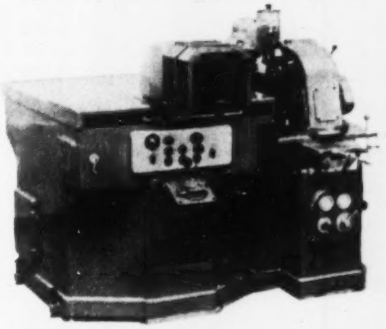




ABSOLUTE GAGE BLOCKS

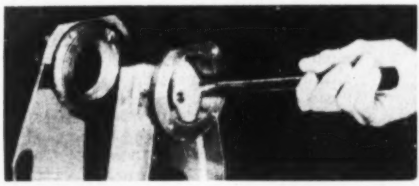
Absolute Gage Blocks are accurate, flat, and the measuring surfaces parallel within millionths of an inch. The size of each Absolute Gage Block is clearly indicated in millionths.

OPTICAL PROFILE GRINDING MACHINE



This Optical Profile Grinder greatly simplifies the manufacture of circular form tools, profile gages, forming rolls, templets, cams, punches, dies, etc. The desired profile is drawn with India ink on a transparent plastic sheet to any desired enlarged scale between 10:1 to 50:1. This drawing is placed on the projection table and the workpiece is ground to the layout. The projection table with the layout is moved hydraulically and controlled by two control levers. The optical system produces a sharp image on the screen. Speed of grinding wheel is 3,800 or 5,000 R.P.M.

OPTI-MIKE



The new Opti-Mike enables an unskilled operator to make a quick and accurate measurement of a bore diameter. It does not depend upon the operator's skill or "feel," as is necessary with an internal micrometer. The operator or inspector merely inserts the head end of the instrument into a bore at a slight angle, and by making a sweep of a few degrees, a measurement is taken. The head end of the instrument is held up to the eye and the dimension is quickly and easily read directly to 0.00025 inch. These instruments cover a range of 0.8 inch to 6 inches.

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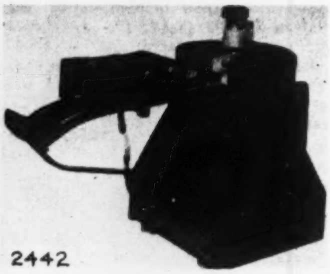
are magnetized by passing a current directly through metal or through a surrounding cable. Magnetic iron oxide or precipitated iron powder is distributed over surface of magnetized object and particles align themselves to reveal defects.—*Research & Control Instruments Div., North American Philips Co., Inc., 750 S. Fulton Ave., Mount Vernon, N. Y.*

For more information circle **510** on inquiry card.

Vibration Exciter

New small shaker produces frequencies up to 10,000 cps. for production vibration testing of sub-miniature electron tubes rigidly clamped in vibrating armature; also has a flat-top table for calibrating small vibration pickups and accelerometers.—*The MB Mfg. Co., 1060 State St., New Haven 11, Conn.*



For more information circle **511** on inquiry card.

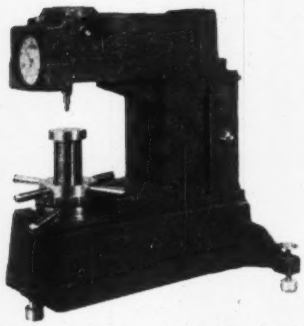
Universal Testing Machine

New "Model L" is exceptionally tall (75-in. "daylight") for its seven available capacities which range from 0-250 lbs. to 0-10,000 lbs. Will test in tensile, compression, transverse, and shear. Hand-operated or motorized. Variable-speed drives available. Choice of 5-in. or 10-in. dials, with lb. or kg. calibration. Immediate shipment.—*W. C. Dillon & Co., Inc., P. O. Box 3008, Van Nuys, Calif.*

For more information circle **512** on inquiry card.

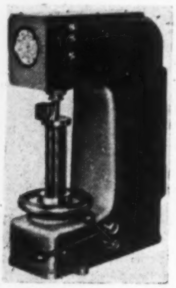
Hardness Tester

New "Kentrall Hardness Tester" is said to be the first machine designed to make tests utilizing all scales: all regular Rockwell tests (60, 100 and 150-kg. loads) and superficial tests (15, 30 and 45 kg. loads) with any suitable standard "C", "N" or ball type indenter. Minor and major loads are applied by dead weights. Testers are built in several vertical capacities.—*Torsion Balance Co., Clifton, N. J.*



For more information circle **513** on inquiry card.

Rockwell-hardness Tester



New "Model HT-1 Wolpert-Gries Rockwell Hardness Testing Machine" (European-made) can perform 400 tests per hour. Its 10-kg. minor load is produced by gravity instead of by spring pressure. After minor load is applied, no "setting" is required to make dial indicator stand at correct zero. Without taking his hand off spindle wheel, operator can release oil brake, applying major load through weight block suspended on loading lever.—*Testing Machines Div., Gries Industries Inc., New Rochelle, N. Y.*

For more information circle **514** on inquiry card.

Jet Engine Monitor

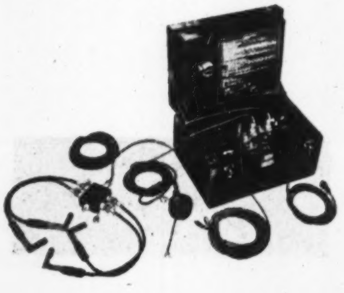
New "Pressure Ratio Indicator," said to be "the first instrument for accurately measuring jet engine performance," permits pre takeoff engine checks; enables pilot to obtain the most efficient power settings when climbing and cruising. It indicates ratio of total engine pressure at tailpipe and at inlet. When airborne, pilot watches dial and holds given ratio.—*Kollsman Instrument Corp., 80-08 45th Ave., Elmhurst, N. Y.*

For more information circle **515** on inquiry card.

ELECTRICAL TESTING

Jet Aircraft Tester

New "Jetcal Tester" tests temperature measuring systems of jet engines, aircraft overheat detectors and anti-



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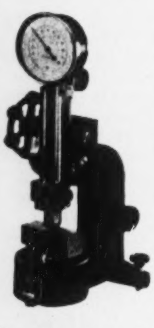

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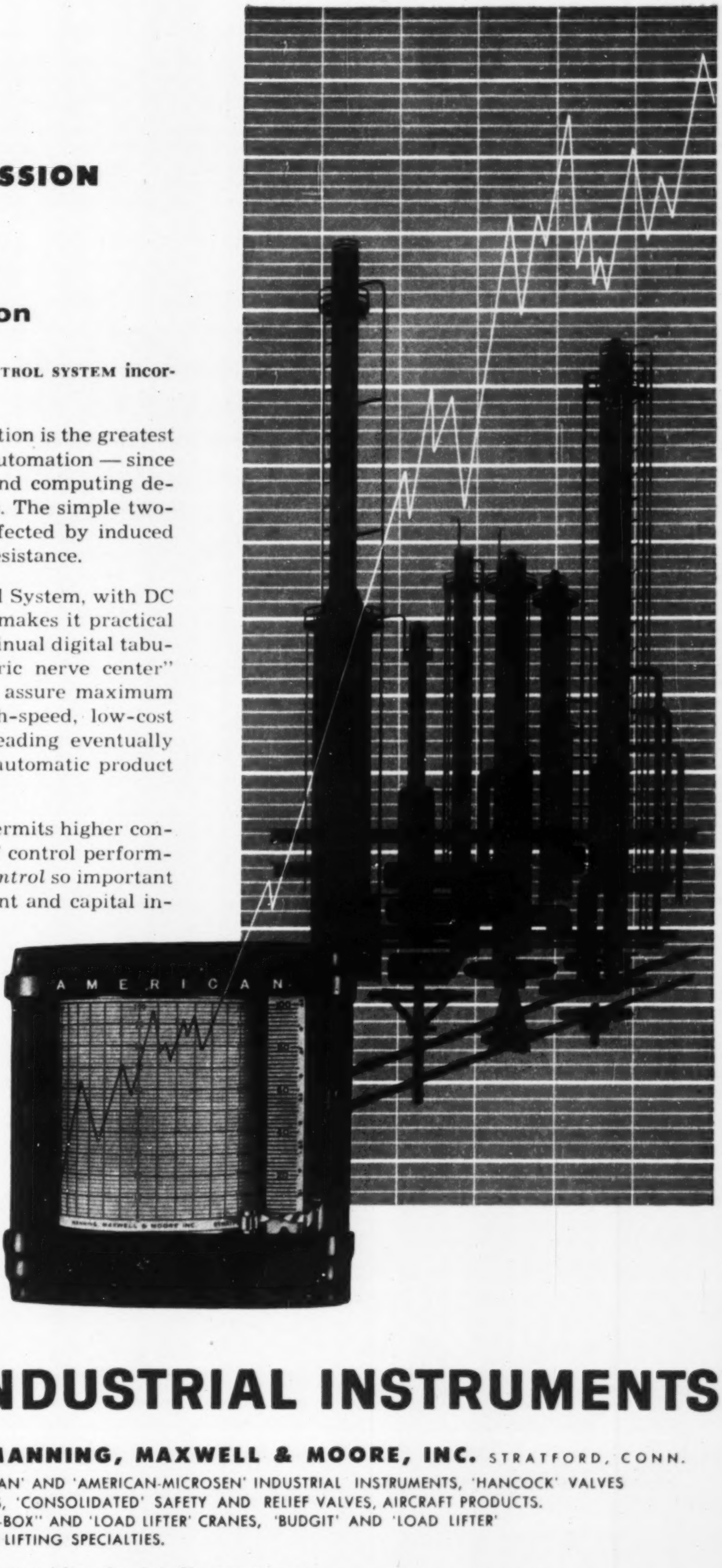

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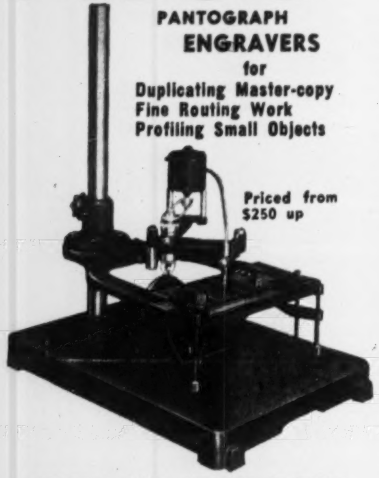

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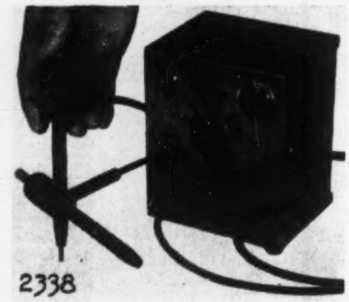
For more information circle 88 on inquiry card.

ice devices, is said to "perform a function generally considered impossible by engineers to whom it is first presented until the functioning is explained and proved." Its rapid (10- to 30-minute) engine test safeguards pilots' lives.—*B & H Instrument Co., Inc., Fort Worth, Texas.*

For more information circle **516** on inquiry card.

High-voltage Tester

New "Model 101" is designed for production line use, features a buzzer signal on insulation breakdown, retracting test prods suitable for women operators, and easy shop servicing. Input is 115 v.ac.; output is six common testing voltages between 500 and 2500 v.ac.—*Slaughter Co.,* 1700 *Nicklin Ave., Piqua* 7, *Ohio.*



2338

For more information circle **517** on inquiry card.

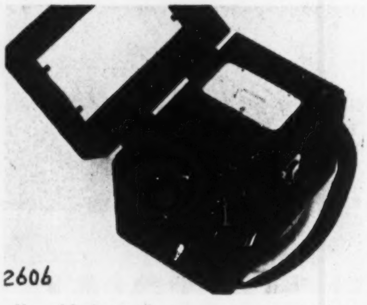
Tube Tester

New "Model 208" checks all octal, loctal, miniature and noval base tubes for tube quality as well as shorts, leakages, continuity or opens between any two elements of tube regardless of location of defect; is for all present and future tubes. Feature enables "Model 208" to match and check hi-fi tubes. A picture tube adapter is available.—*Electronics Measurements Corp.,* 280 *Lafayette St., New York* 12, *N. Y.*

For more information circle **518** on inquiry card.

Insulation Tester

New "No. 250 Vibrotest" for shop and field use features 1-50,000 megohm range at 500 v.d.c. test potential, all-welded steel case construction, closely-regulated test voltage (0.25 percent) and choice of four megohm ranges. It is 115-v.ac. line operated and independent of line fluctuation between 95 to 135 volts.—*Associated Research, Inc.,* 3767 *W. Belmont Ave., Chicago* 18, *Ill.*

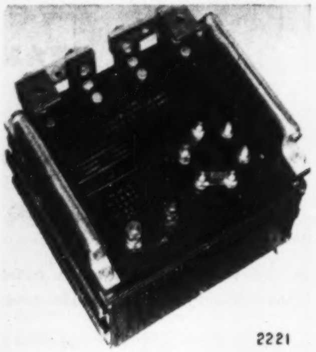


2606

For more information circle **519** on inquiry card.

Tester for Overload Protective Devices

New "Type CL-5 Knopp Loading Transformer," designed for portable field-testing, provides current for testing current-actuated overload protective devices; has input of 90, 100, 180 and 220 volts. Output: 5 v. 1000 amps. and 10 v. 500 amps. Weight 60 lbs.—*Electrical Facilities Inc.,* 4250 *Holden St., Oakland* 8, *Calif.*



2221

For more information circle **520** on inquiry card.

Resistance Tester

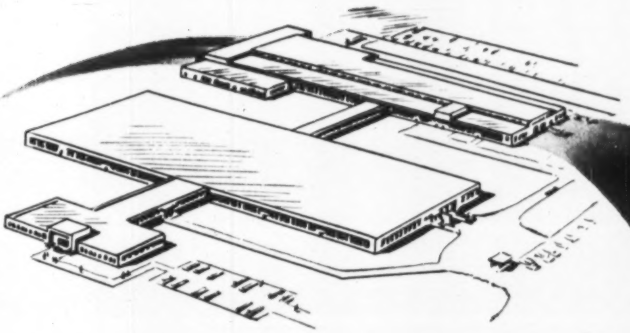
New "Model R-10 Signa-glow," for resistance measurement, can be held in user's hand; features rapid action, and a unique null indicator incorporated into a Wheatstone bridge circuit. Range 5 ohms to 50 megohms. Scale marked 5 to 10,000 ohms has a center pointer knob. Direction of null appears at a glance by lighting of either of a pair of neon lamps. Three-position multiplier switch for ranges of 0.01, 1 and 100 times scale.—*Industrial Development Laboratories,* 17 *Pollock Ave., Jersey City* 5, *N. J.*

For more information circle **521** on inquiry card.

Microwave Dielectric Tester

New "Microwave Dielectrometer" for measuring dielectric constant and loss of a wide variety of materials operates at nominal frequencies of 1000, 3000 and 8500 Mc. corresponding to free-space wavelengths of 30, 10 and 3.5 cm.; comprises: slotted waveguide; precision traveling probe;

2379



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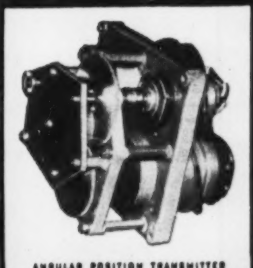

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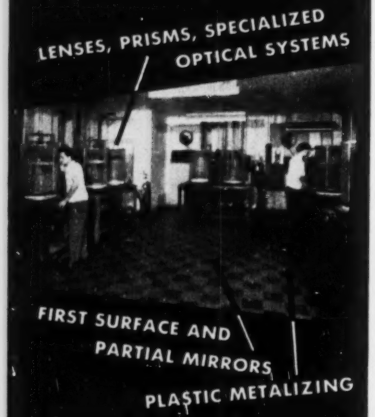

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For more information circle **91** on inquiry card.

probe-output amplifier; separate square-wave modulated klystron oscillators for each frequency; associated power supplies and equipment.—*Dep't KP, Central Research Laboratories, Inc., Red Wing, Minn.*

For more information circle **522** on inquiry card.

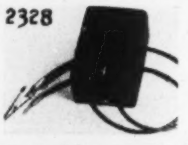
Transistor Test Set

New "Model GP 1" features direct measurement of transistor characteristics at any frequency from 100 cps to 1 Mc. *N-p-n* and *p-n-p* transistors may be tested in either grounded-base or grounded-emitter configuration. Coefficients are read directly and include hybrid, equivalent "T", and "black box" parameters, alpha cut-off, collector capacitance and I_{CO}, as well as current gain and voltage feedback ratio.—*Baird Associates, Inc.*, 33 *University Rd, Cambridge* 38, *Mass.*

For more information circle **523** on inquiry card.

Appliance Tester

New appliance and circuit tester locates electrical trouble in seconds; may be operated by anyone following simple instructions.—*Krest Products Co.*, 1303 *W. Jackson Blvd., Chicago, Ill.*



For more information circle **524** on inquiry card.

CRT Tube Tester

New "Model 101" weighs 5½ lbs., provides a positive test indication within 90 seconds for continuity and emission. All phases of potential trouble and breakdown are clearly outlined on front panel. No additional computations are necessary.—*Authorized Manufacturers Service Co.*, 919 *Wyckoff Ave., Brooklyn, N. Y.*

For more information circle **525** on inquiry card.

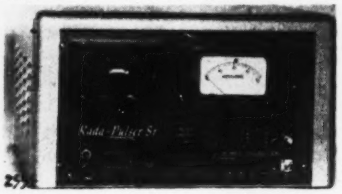
Field-test Frequency Meters

New line of field test frequency meters is added to maker's standard line of wavemeters. Ranges covered: 900-1200, 1200-1700, 1700-2300, 4400-5800 and 5800-8200 Mc. Accuracy of "Models 1217 and 1723" is 0.02 percent; all others 0.01 percent. "Models 4458 and 5882," which operate in TE_{111} mode, are sealed and feature a built-in desiccator.—*Frequency Standards, Box* 504, *Asbury Park, N. J.*

For more information circle **526** on inquiry card.

Pulse-carrier Generator

New "Rada-Pulser Sr." has continuously-variable calibrated frequency range from 12 to 80 Mc.; calibrated variable pulse widths from 0.2 to 20 usec.; pulse rise and fall 0.03 usec.; repetition rate calibrated 300 to 3000 pps.—*Kay Electric Co., Pine Brook, N. J.*



For more information circle **527** on inquiry card.

Gain-measuring Set

New "Radalyzer" has a 30-Mc. IF for low-level microwave measurements. Among features. gain-loss measuring range 0 to more than 60 db VSWR. Zero to more than 60 db insertion loss or gain; regulated voltages for two external klystrons; AFC amplifier controls LO repeller voltage to accurately maintain 30 Mc. IF.—*Kay Electric Co., Pine Brook, N. J.*

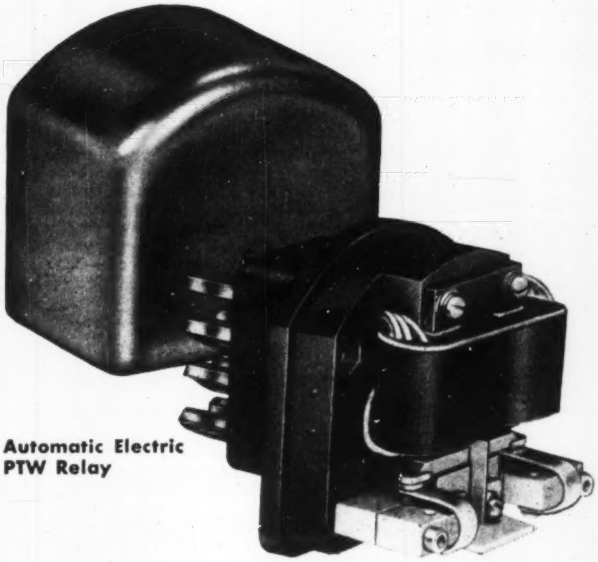
For more information circle **528** on inquiry card.

Preset Interval Generator

New "Model 564 Preset Interval Generator," for testing and calibrating systems that rely on precise time measurements for their operation, permits time intervals and delays

New polar relay...

sensitive, rugged, compact!



Automatic Electric PTW Relay

Here's a new polar relay that will soon be setting records for long service life! Its sensitivity gives peak performance for high-speed polarized pulse repeating, or for applications where low current is transmitted over long lines. The Series PTW Relay is also recommended for line-current direction indication or as a differential relay in the "Wheatstone Bridge" type of control. Advanced features include:

simplified design and long service life

New design eliminates many parts and adjustments formerly required. Relay gives *billions* of operations without re-adjustment.

extreme sensitivity

Unit operates on currents as low as 2 to 12 milliamperes, depending upon number and combination of windings used. Signals as low as 10 milliwatts through the two line-windings will "trigger" the relay.

reduced bounce and wear

A new method of armature support limits longitudinal movement. There are no bearings to wear . . . the usual rocking motion in contact make-and-break is reduced. Armature bounce is virtually eliminated; contacts last longer.

improved characteristics in smaller size

Because of increased magnetic efficiency, the coils take less space and need fewer turns. The lower coil impedance of this compact unit gives improved characteristics.

fast response

Travel time is as low as .9 milliseconds, depending upon contact gap and windings used.

send for circular

For a small, fast, sensitive polar relay that out-performs and outlasts all others, specify this new Automatic Electric Series PTW Relay. For details ask for Circular 1821. Write: Automatic Electric Sales Corporation, 1033 West Van Buren St., Chicago 7, Ill. In Canada: Automatic Electric (Canada) Ltd., Toronto. Offices in principal cities.

helpful technical data

Make and Break—75% total "make" on both contacts at 60 cycles per second with .006" contact gap and 23 milliamperes of sine wave ac. Simple, easy re-adjustment can be made in the field.

Windings—Four windings: two line-windings, each 139 ohms resistance and only .5 henry inductance; other two windings, each 101 ohms and .125 henry. The number of coil turns to be placed in series aiding can vary from 1400 to 8400.

Cover—Snap-on cover easily removed for inspection and adjustment of relay.

Mounting—Jack mountings, available for flush or surface mounting.

Size—2¼" wide, 2½" deep and 2¹¹⁄₁₆" high (plus ⅝" projection of banana plugs).

For more detailed information, ask for Circular 1821.

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For more information circle **94** on inquiry card.

from 1 microsecond to 1 second to be generated or measured. In generating an interval or delay, desired number of microseconds is selected by means of six 10 position switches, one for each digit of delay in microseconds. To measure an existing time interval, instrument counts exact number of pulses produced by a 1-Mc. crystal-controlled oscillator during the interval. Maker states that "many new circuits have been incorporated to make the 564 the most versatile instrument available for short time measurement and generation."—*Potter Instrument Co., Inc., 115 Cutter Mill Rd, Great Neck, L. I., N. Y.*

For more information circle **529** on inquiry card.

High-voltage Probe

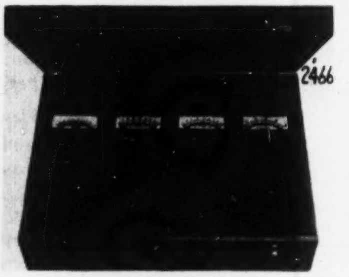
New "Model HVP-2" high-voltage probe, designed for use with any VTVM or 20,000-ohms/volt instruments, permits measurements up to 30,000 volts; comes completely factory-wired; features "new 6-way safety protection."—*Electronic Instrument Co. Inc., 84 Withers St., Brooklyn 11, N. Y.*

For more information circle **530** on inquiry card.

ELECTRICAL INSTRUMENTS

Universal A-c. Test Set

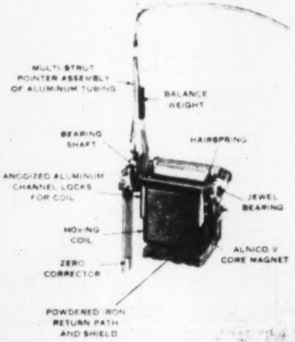
New "Model U60AC" gives complete picture of 60-cps. voltages, currents, power and power factor; comprises four instruments with requisite switches, providing 7 current ranges, 4 voltage ranges and 36 wattage ranges (two wattmeters, permitting 3-phase measurements); also may be used for core-loss measurements, servomotor measurements, etc.—*Sensitive Research Instrument Corp., 9 Elm Ave., Mount Vernon, N. Y.*


2466

For more information circle **531** on inquiry card.

Moving-coil Mechanism

New p-m. m-c. electrical-instrument mechanism is said to be of unique design providing "performance stability typical of that of a gyro." End-pivoted coil assembly with one-piece bearing shaft operates in a self-shielded magnet structure, produces approx. 6000 gauss in a single air gap. Performance characteristics also suggest application in control devices.—*Marion Electrical Instrument Co., Manchester, N. H.*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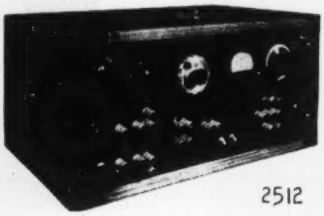
JEWEL BEARING
MOVING COIL
ALNICO V CORE MAGNET
ZERO CORRECTOR
POWDERED IRON RETURN PATH AND SHIELD

For more information circle **532** on inquiry card.

Ratiometer

New "Precision Ratiometer" is a laboratory, production or field instrument, for extremely accurate determination of either impedance ratios or absolute values of resistors. It has two resistive networks that may be used separately or in conjunction with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OUTPUT CURRENT MAY BE SET AT ANY VALUE FROM 0.2 TO 50 M.A. D.C. AS LOAD VOLTAGE VARIES BETWEEN 0-150 V. MODEL 1A-R IS CONSTANT WITHIN 1%. MODEL 1B-R WITHIN 0.1%.

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STANDARD SIGNAL GENERATOR MODEL 65-B

FREQUENCY RANGE	OUTPUT RANGE	MODULATION
75 Kc.—30 Mc.	0.1 microvolt to 2.2 volts	AM. 0 to 100% 400 cycles or 1000 cycles External mod., 50-10,000 cycles

STANDARD SIGNAL GENERATOR MODEL 78

FREQUENCY RANGE	OUTPUT RANGE	MODULATION
15-25 Mc.; 195-225 Mc. 15-25 Mc.; 90-125 Mc. Other ranges on order	1 to 100,000 microvolts	AM. 8200-400 cycles 625—400 cycles Fixed at approximately 30%

STANDARD SIGNAL GENERATOR MODEL 78-FM

FREQUENCY RANGE	OUTPUT RANGE	MODULATION
86 Mc.—108 Mc.	1 to 100,000 microvolts	Deviation 0-300 Kc. 2 ranges FM. 400 and 8200 cycles External mod. to 15 Kc.

STANDARD SIGNAL GENERATOR MODEL 80

FREQUENCY RANGE	OUTPUT RANGE	MODULATION
2 Mc.—400 Mc.	0.1 to 100,000 microvolts	AM. 0 to 30% 400 cycles or 1000 cycles External mod., 50-10,000 cycles

STANDARD SIGNAL GENERATOR MODEL 82

FREQUENCY RANGE	OUTPUT RANGE	MODULATION
20 cycles to 200 Kc. 80 Kc. to 50 Mc.	0-50 volts 0.1 microvolt to 1 volt	Continuously variable 0-50% from 20 cycles to 20 Kc.

STANDARD SIGNAL GENERATOR MODEL 84

FREQUENCY RANGE	OUTPUT RANGE	MODULATION
300 Mc.—1000 Mc.	0.1 to 100,000 microvolts	AM. 0 to 30%, 400, 1000, or 2500 cycles. Internal pulse modulator. External mod., 50-30,000 cycles.

STANDARD SIGNAL GENERATOR MODEL 84-TV

FREQUENCY RANGE	OUTPUT RANGE	MODULATION
300 Mc. to 1000 Mc.	Continuously variable from 0.1 microvolt to 1.0 volt	Continuously variable 0 to 30% External modulation 20 to 20,000 cycles.

STANDARD SIGNAL GENERATOR MODEL 90

FREQUENCY RANGE	OUTPUT RANGE	MODULATION
20 Mc.—250 Mc	0.3 microvolt to 0.1 volt	Continuously variable, 0 to 100% Sinusoidal modulation 30 cycles 5 mc. Composite TV modulation.

PULSE GENERATOR MODEL 79-B

FREQUENCY RANGE	PULSE WIDTH	OUTPUT
60 to 100,000 cycles	Continuously variable from 0.5 to 40 microseconds	Approx. 150 v. positive with respect to ground. "Sync Output" 35 v. positive with respect to ground.

SQUARE WAVE GENERATOR MODEL 71

FREQUENCY RANGE	WAVE SHAPE	OUTPUT
Continuously variable 6 to 100,000 cycles	Rise time less than 0.2 microseconds with negligible overshoot	Step attenuator 75, 50, 25, 15, 10, 5 peak volts fixed and 0 to 2.5 volts continuously variable

VACUUM TUBE VOLTMETERS

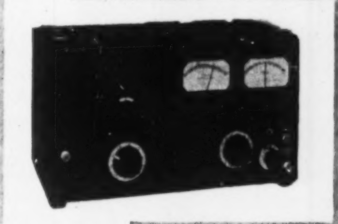
MODEL 62

VOLTAGE RANGE	FREQUENCY RANGE	INPUT IMPEDANCE
0-1, 0-3, 0-30 and 0-100 volts AC or DC	30 cycles to over 150 Mc.	Approximately 7 mmfd.

MODEL 67

VOLTAGE RANGE	FREQUENCY RANGE	INPUT IMPEDANCE
.0005 to 300 volts peak-to-peak	5 to 100,000 sine-wave cycles per second	1 megohm shunted by 30 mmfd.

CRYSTAL CALIBRATOR MODEL 111



STANDARD SIGNAL GENERATOR MODEL 80

MEGACYCLE METER MODEL 59

U.H.F. FIELD STRENGTH METER MODEL 58

FREQUENCY RANGE	INPUT VOLTAGE RANGE
15 Mc. to 150 Mc.	1 to 100,000 microvolts in antenna. 1 to 100 microvolts on semi-logarithmic output meter, balanced resistance attenuator with ratios of 10, 100 and 1000 ahead of all tubes.

INTERMODULATION METER MODEL 31

INTERMODULATION RANGE	FREQUENCIES (CYCLES)	ANALYZER INPUT VOLTAGES
3%, 10% and 30% Full scale	LF 60 cps HF 3000 cps	Full scale ranges of 3, 10, 30 volts RMS

MEGACYCLE METERS MODELS 59LF—59—59UHF

FREQUENCY RANGE	FREQUENCY ACCURACY	MODULATION
0.1 Mc to 4.5 Mc 2.2 Mc to 400 Mc 430 Mc to 940 Mc	Within ± 2%	CW or 120 cycles fixed at approximately 30%. Provision for external modulation

CRYSTAL CALIBRATORS

MODEL 111

FREQUENCY RANGE	FREQUENCY ACCURACY	HARMONIC RANGE
250 Kc.—1000 Mc.	0.002%	.25 Mc. Oscillator .25-450 Mc. 1 Mc. Oscillator 1-600 Mc. 10 Mc. Oscillator 10-1000 Mc.

MODEL 111-B

FREQUENCY RANGE	FREQUENCY ACCURACY	HARMONIC RANGE
100 Kc.—1000 Mc.	0.002%	.1 Mc. Oscillator .1 — 450 Mc. 1 Mc. Oscillator 1 — 600 Mc. 10 Mc. Oscillator 10 — 1000 Mc.

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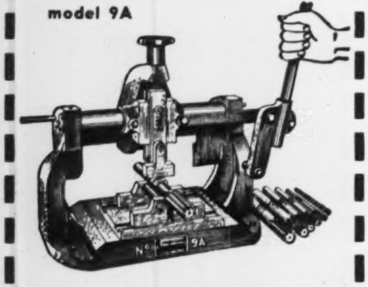
For more information circle 95 on inquiry card.



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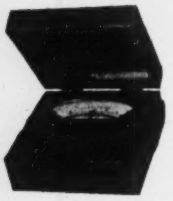

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The only portable fluxmeter available which returns rapidly to zero when a single button is depressed. Simple and fast in operation. Convenient and light in weight.

Not limited to a single type of measurement. Has universal application for laboratories or production. Measures strength of magnets and electromagnets, permeability and hysteresis loops for iron and steel, total flux lines in circuit, flux lines developed in air gap, etc.

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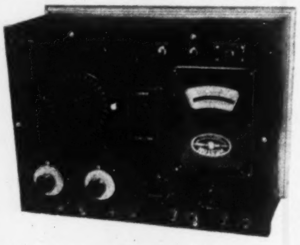
For more information circle **97** on inquiry card.

each other; a transformer for either a-c. inputs or as an a-c. null detector; microammeter for d-c. measurements; calibrated capacitor to null out reactive components that exist in resistors; and scale-selector switches. It is readable to five significant figures. —*Cal-Tronics Corp.,* 11307 *Hindry Ave., Los Angeles* 45, *Calif.*

For more information circle **533** on inquiry card.

Deflection Potentiometer

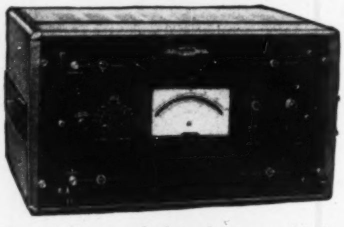
New "Brooks Deflection Potentiometer" has all main dial contacts beneath panel: free from dust and dirt, thereby improving stability and operation. It is for use where d-c. ammeters, voltmeters, or wattmeters are to be checked daily; or where currents or voltages are to be measured rapidly; or current and voltage in rapid succession. Major portion of reading is taken on potentiometer dial having 5-mv. steps; final balance on calibrated galvanometer reading to 0.1 mv. (to 0.02 mv. by interpolation) over a total range of 153 mv.—*Gray Instrument Co.,* 64 *W. Johnson St., Philadelphia* 44, *Pa.*



For more information circle **534** on inquiry card.

Phase Meter

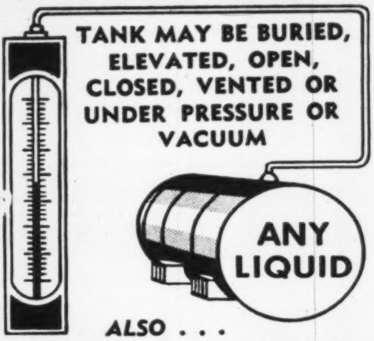
New "Type 322-A Precision Phase Meter" indicates phase angles from 0 to 360 deg. with an absolute accuracy of 1 deg. Incremental changes in relative phase angles are read with an accuracy of 0.1 deg. on 30-deg. expanded scale. Phase-angle indications being based on corresponding positive-going zero-axis crossings of applied signals, measurements are independent of applied wave-form if there is no more than one zero-axis crossing per half-cycle.—*Technology Instrument Corp., Acton, Mass.*



For more information circle **535** on inquiry card.

Signal-gain Generator

New "Model SU-200" is said to be a radically new UHF signal-gain generator. Among features: maker's unique coaxial tuning elements; contiuous precise tuning over entire UHF band; calibration in both frequency and channel designations. Instrument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For more information circle **99** on inquiry card.

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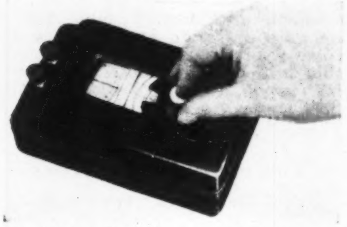
measures gain, tracking, calibration, accuracy and range of UHF tuners, converters, etc.; can act as a signal power source for various types of measuring equipment.—*Granco Products Inc., 36-17 20th Ave., Long Island City 5, N. Y.*

For more information circle **536** on inquiry card.

Single-knob Bridge

New "Type ZK Single-knob Measuring Bridge" covers six resistance ranges from 40 milliohms to 50,000 ohms, operated by a standard type 4.5-v. dry cell battery. It obviates need of manipulating many ratio and resistance decade knobs and adding and multiplying many figures. Announcement asserts: "Errors are impossible."—*Herman H. Sticht Co., Inc., 27 Park Place, New York 7, N. Y.*



For more information circle **537** on inquiry card.

Voltage Calibrator

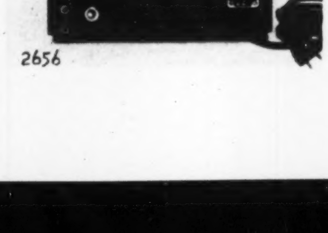
New "Model TG-2," for laboratory applications, features multi-turn dial for measuring and calibrating voltages as low as 0.001 v. peak-to-peak. It increases usefulness of lab 'scopes. Total range 100 v. peak-to-peak. Power source 105/125 v.ac.; weight 5 lbs.—*G. W. Associates, P.O. Box 2263, El Segundo, Calif.*

2658

For more information circle **538** on inquiry card.

High-frequency Detector

New "Type 1216-A Unit I-F Amplifier," latest of maker's "unit instruments," makes available a sensitive detector for signals in 25-50-Mc. range in conjunction with maker's "Type 874-MR" mixer rectifier and a suitable unit oscillator. A gain of 100 db makes possible a sensitivity of about two microvolts of 30-Mc. input for indicator deflection of 1 percent over



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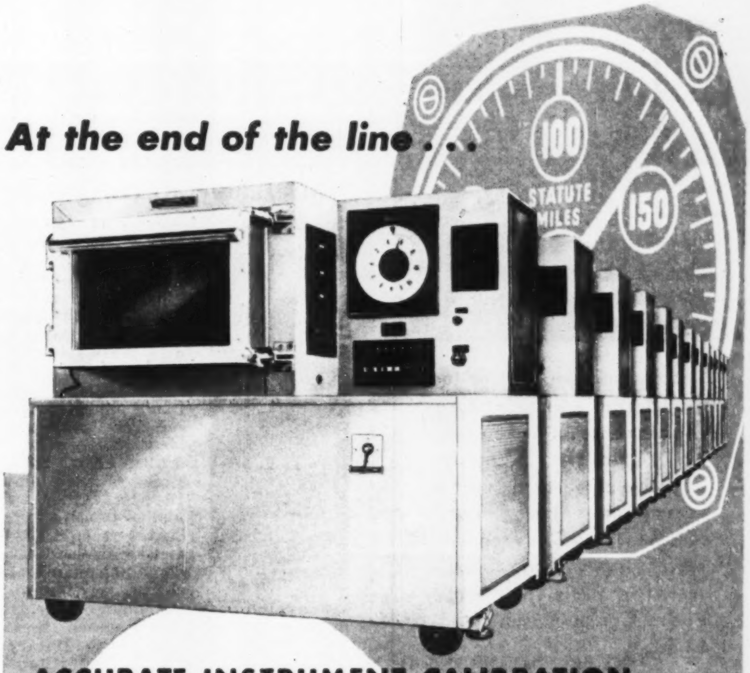

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ALTITUDE: −1000 ft. to 80,000 ft.
PRESSURE: 5" mercury above atmospheric
REFRIGERANT: F-22
WORK SPACE: 15" d., 18" h., 30" w.
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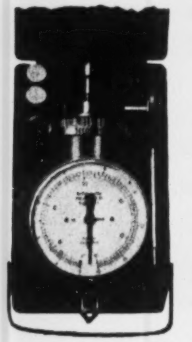
For more information circle **101** on inquiry card.

Five Range Hand Tachometer

Indispensable in Laboratories, Industrial and Power Plants.



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Model A	30—12,000 RPM
Model B	45—18,000 RPM
Model C	60—24,000 RPM
Model D	120—48,000 RPM

Linear speeds in feet per minute can also be measured by using the cut-meter wheel.

Write for circular 106.

Amthor Testing Instrument Co., Inc.
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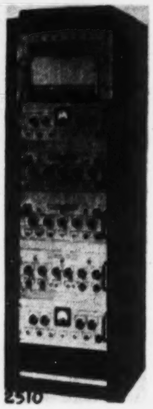
Brooklyn 7, New York

For more information circle **102** on inquiry card.

residual noise. For use with null-type measuring devices, an AVC control position is available on panel switch. —*General Radio Co., Cambridge 39, Mass.*

For more information circle **539** on inquiry card.

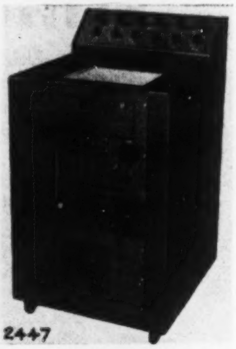
Multichannel Oscillographs



New 4- and 6-channel direct-writing oscillographs feature an electrically-controlled chart-drive system which permits instantaneous selection of speeds, from 1 cm./hr. to 25 cm./sec., on front panel or from remote control unit. New units can be mounted on roller slides in a standard 19-in. rack, or furnished in console for bench or cart. Both ink-writing and combination ink and electric writing units are available, using maker's electrodynamic "Penmotors" which record dynamic phenomena up to 100 cps. when used with maker's amplifiers.—*Dep't RT-1, Brush Electronics Co., 3405 Perkins Ave., Cleveland 14, Ohio.*

For more information circle **540** on inquiry card.

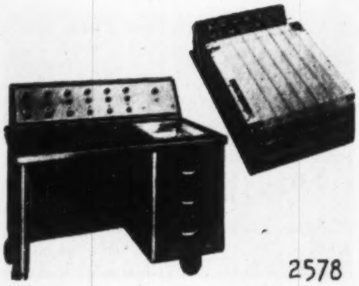
Six-channel Recorder



New "MC-300" is a 6-channel recorder with provisions for both electric and ink recording; suitable as a laboratory test instrument or with analog computer equipment. Amplitude response flat to 40 cps. at a peak-to-peak amplitude of 20 mm. Paper speeds of 1 to 50 mm/sec. easily selected by a knob. Unit is self-contained with regulated voltage supplies and with six high-gain low-drift d-c. amplifiers. Standard cell provided for calibration.—*Mid-Century Instrument Corp., 611 Broadway, New York 12, N. Y.*

For more information circle **541** on inquiry card.

Console Recorder

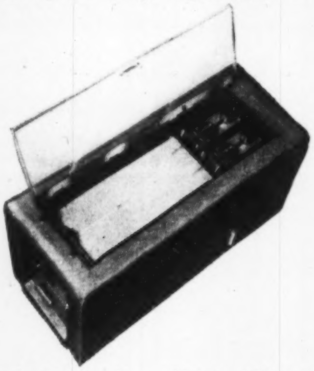


New "Model F6C" has direct-writing oscillograph available for curvilinear ink recording, curvilinear electric recording or rectilinear ink recording; is suitable for use with many computers now on market. Six chart speeds: 0.5 to 25 mm/sec. Frequency response with compensated amplifiers is flat to 60 cps. Console is available with ac., dc. high-gain, dc low-gain or strain amplifiers. ★ Oscillograph pictured by itself is available without console.—*The Photron Instrument Co., 6520 Detroit Ave., Cleveland 2, Ohio.*

For more information circle **542** on inquiry card.

Two-channel Recorder

New "Model 8082" two-channel oscillograph embodies several exclusive improvements: Noise has been eliminated by use of nylon gear drives. Six chart speeds, from 2½ to 100 mm./sec., instant shift while unit is operating and when it is turned off. Deposited-metal drive roll and positive non-slip paper adjustments permit use of rolled or folded paper. Ink is drawn through a non-clog system on true curvilinear coordinates.—*Edin Co., 207 Main St., Worcester 8, Mass.*



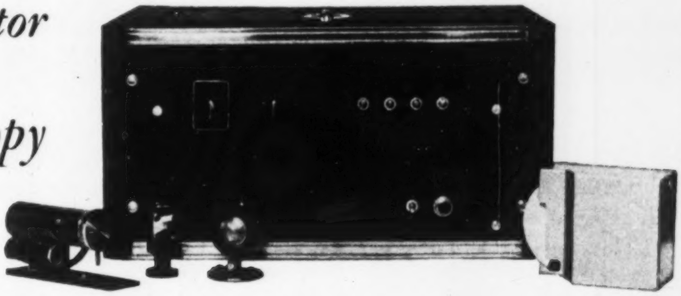
For more information circle **543** on inquiry card.

Miniature Recorder

New "Model 6401 and 6402" lightweight (7½-lb.) direct-writing recorder for voltage and current records, in both a-c. and d-c. models, features maker's self-shielded "Cormag" instrument mechanism: magnetic field created by a conductor carrying 15,000

A Superior Detector
for
Infra-Red Spectroscopy

GOLAY PNEUMATIC DETECTOR



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4. Improved, drift-free, A.C. operated amplifier with step gain controls and four response periods.

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THE EPPLEY LABORATORY, INC.
SCIENTIFIC INSTRUMENTS
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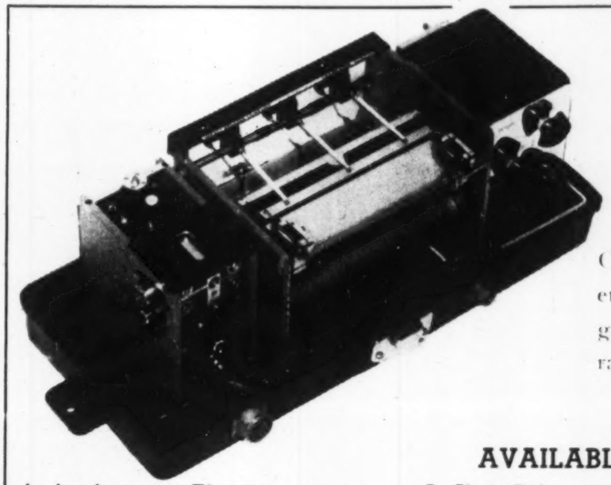


THREE COMPONENT ACCELEROMETER

One of the finest, direct-recording, mechanical accelerometers built. Thirty-five years' experience have gone into the design of this ruggedly built, accurate and dependable instrument.

AVAILABLE WITH THE FOLLOWING FEATURES:

A. Accelerometer Elements
Wide range of frequency and G.
Elements are ball bearing mounted for minimum hysteresis loss.
Accuracy is 2% of full scale.
All elements are linear and are damped.

B. Recording Chart
7" Wide, wax coated, 2" trace per G.
Instantaneous records — no developing required.

C. Chart Drive
400 Cycle—115 volt synchronous for direct or remote operation.
60 Cycle—115 volt synchronous for direct or remote operation.
Spring driven motors for 8, 16 or 30 day operation.

D. Chart Speed
½"/hour to 60"/minute in single or two speed selection.
Wider ranges furnished on request.

E. Recording Styli
Heat or pressure recording type, sapphire tipped.

F. Usage
Package testing, impact testing, riding qualities of all types of vehicles for land, sea, aircraft and missile work.

G. Size and Weight
16"x8"x8"—Weight, 18 pounds.

For further details write:

Impact Register Company, P. O. Box 445, Champaign, Ill.

For more information circle **104** on inquiry card.

New!

REMOTE INDICATING LIQUID LEVEL MEASURING SYSTEM

Contact With Liquid Not Necessary—Measuring done external to pipe, tank or vessel...

REMOTE INDICATING—
Up to 15 miles from measuring point.

SIMPLE—
Has no moving parts... Requires only two connecting wires... Drives any 10 millivolt potentiometric recorder.

ACCURATE—
Indicates changes as small as fractions of an inch ... Environmental conditions of temperature and moisture have negligible effect on accuracy.

INEXPENSIVE—
No d.c. amplifier required ... No expensive cables.

TROUBLE FREE—
Requires maintenance only once a year... No booster amplifier or vacuum tube power supply required.

PRINCIPLE OF OPERATION—
Uses revolutionary Neher-White Ionization Chamber with small radioactive source. Low impedance chamber output of 40 microamps requires no additional amplification. Simple, inexpensive, low voltage battery power supply, uses mercury cells for stable voltages.

APPLICATIONS—
Tank farms... Boilers using high pressure and high temperature systems... Refineries and Chemical plants handling corrosive or high temperature liquids... Conventional flow systems.

Write for application data file #20 ... or send details with quotation request

Jordan Electronic Mfg. Co., Inc.
119 East Union Street • Pasadena 1, California

For more information circle **105** on inquiry card.

amps. 3 ft. from instrument would cause a temporary error of less than 1 percent. This mechanism, using a large movable coil, has a high torque-to-weight ratio, and allows increased sensitivity where needed. D-c. "Model 6401" is available in ranges from 1 ma. to 5 amps. and from 100 mv. to 300 v. For a-c. measurement, rectifier "Model 6402" is available in ranges up to 5 amps. and up to 300 v., self-contained.—*Weston Electrical Instrument Corp., 614 Frelinghuysen Ave., Newark 5, N. J.*

For more information circle **544** on inquiry card.

VT Electrometer

New "Model 210" is a line-operated d-c. VTVM with an extremely high input impedance. Input greater than 10^{14} ohms; grid current below 10^{-13} ampere; drift within 10 mv. per hour; five voltage ranges to 80 volts in either polarity; output terminals for driving balanced or unbalanced recorders and recorder amplifiers, oscilloscopes, and galvanometers.—*Keithley Instruments, 3868 Carnegie Ave., Cleveland 15, Ohio.*

For more information circle **545** on inquiry card.

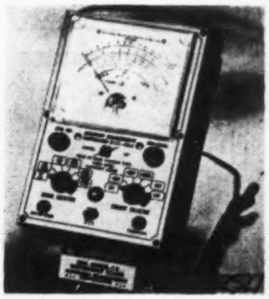
VTVM

New "Model 232 Peak-to-Peak VTVM," designed for TV servicing, features new "Dual Purpose AC/DC Uni-Probe" and an exceptionally stable push-pull triode bridge circuit, with accuracy unaffected by line voltage variation. It reads peak-to-peak voltage of complex and sine waveforms, rms. voltage of sine waves, d-c. voltage, and resistance. Seven non-skip ranges on every function assure a uniform 3-to-1 scale ratio between adjacent ranges for extreme wide-range accuracy. Center-scale zero adjustment for TV/FM alignment.—*Electronic Instrument Co., Inc., 84 Withers St., Brooklyn 11, N. Y.*

For more information circle **546** on inquiry card.

VTVM

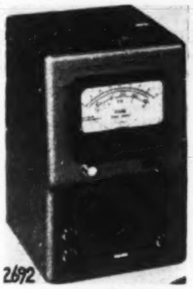
New "Model 107" directly measures capacitance, resistance and complex waveforms peak-to-peak; has new expanded scale with clear plastic cover; uses an electronic balanced push-pull circuit and peak-to-peak rectification, 1-percent multipliers, zero-



center position for FM discriminator alignment.—*Electronic Measurements Corp., 280 Lafayette St., New York 12, N. Y.*

For more information circle **547** on inquiry card.

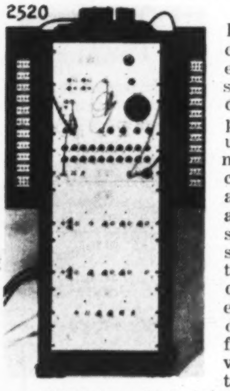
Video Voltmeter


2692

New "Type MV-22 B" VTVM has unprecedented frequency range of 20 cps to 10 Mc. Sensitivity 70 microvolts; highest range 1 kv. Flat frequency response made possible by a combination of extremely heavy degree of negative feedback and frequency-selective circuitry in feedback path. Customary peaking coils in plate circuits are carefully avoided.—*Millivac Instrument Corp., 444 Second St., Schenectady, 6, N. Y.*

For more information circle **548** on inquiry card.

Pulse-height Analyzer

2520


New "Model DZ18" twenty-channel differential analyser sorts pulses according to amplitude; is for use in determining isotopic composition of a given radioactive substance; will also provide statistician and quality-control engineer with distribution function of a variable factor. Pulses are amplified to values between 0 and 60 volts; discriminator covers any 10-volt span within 0-to-60-volt range, in ½-volt increments which form the 20 channels into which pulses are sorted. A "surplus" channel is provided to count all pulses lying outside selected 10-volt span.—*Detectolab, Inc., 6544 Sheridan Rd., Chicago 26, Ill.*

For more information circle **549** on inquiry card.

Cathode-ray Oscilloscopes

New "VS-900 Series Oscillographs" are claimed to set "an entirely new standard for sensitivity and stability." D-c. sensitivity is 700 uv./cm.; a-c. sensitivity 10 uv./cm.; d-c. drifts, af-

Precision WHEATSTONE BRIDGES

Highest Accuracy. . . Minimum Size for Field, Lab, and Production Use

There's a Shallcross Bridge for measuring resistance to any desired precision—indoors or out. Field models have aluminum cases with controls easily adjustable even with a gloved hand. Models for lab, production, and school use feature high readability and simple operation—even for unskilled users.

Accuracy, Stability, and Ruggedness—unsurpassed in any instrument of comparable price.

Selections from the complete Shallcross line are described below. Additional specifications on these, and many other types, are available from SHALLCROSS MFG. CO., 510 Pusey Ave., Collingdale, Pa.

Deliveries ✓ from Stock ✓

WHEATSTONE—FAULT LOCATION BRIDGE No. 6100: 5-dial field model. Locates grounds, crosses, opens, and shorts by Murray, Varley, Hilborn, or Fisher Loop and Capacitance tests. Range: 1 to 1,011,000 ohms. Accuracy: ± 0.1%, + 0.01 ohm. 8⅞" x 7⅜" x 5¾". 8 lbs. *Price: $175.*

KELVIN-WHEATSTONE BRIDGE No. 638-R: Shallcross has pioneered this compact combination of two bridges in one. Range: 0.001 to 11,110,000 ohms. Accuracy: ± 0.3% − 1 to 111,100 ohms. 12½" x 10½" x 6¾". 9 lbs. *Price: $260.*

WHEATSTONE-LIMIT BRIDGE No. 6320: Combines 5-dial Wheatstone and Percent-Limit features. Range: 0.1 to 111,110,000 ohms. Accuracy—*Ratio resistors:* ±.01%, *Rheostat:* ±(.01% to .05% + .005 ohms). 15¾" x 9¼" x 5½". 15 lbs. *Price: $700.*

Shallcross

See us at the Instrument Show: Booths 427-29

For more information circle **106** on inquiry card.

You are invited to see...

THE NEW
Bendix-Pacific
SUPERVISORY CONTROL

at the
FIRST INTERNATIONAL
INSTRUMENT EXPOSITION
in Philadelphia, September 15-21

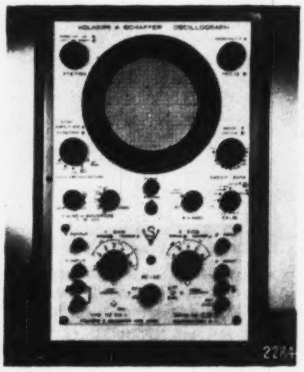
The new Bendix-Pacific Systems represent a noteworthy development for the selective **control** and automatic **indication** of **remotely** located units. The Systems are used in conjunction with ordinary transmission links.

BENDIX BOOTH NUMBERS
103, 104, 105 & 107

Pacific Division
Bendix Aviation Corporation
NORTH HOLLYWOOD, CALIF.

TO MEASURE . . . TO INDICATE . . . TO CONTROL . . . AT A DISTANCE

For more information circle **107** on inquiry card.



ter 5-minute warm-up, seldom exceed 1 mv. Frequency range upper limit 500 kc. (3 db down). Unusual features: dual rms. and peak-to peak calibration; and band selector for minimizing visible input tube noise when operating at maximum sensitivity.—*Volkers & Schaffer Mfg. Corp., 1679 Broadway, Schenectady 6, N. Y.*

For more information circle **550** on inquiry card.

Charge-rate Ammeter

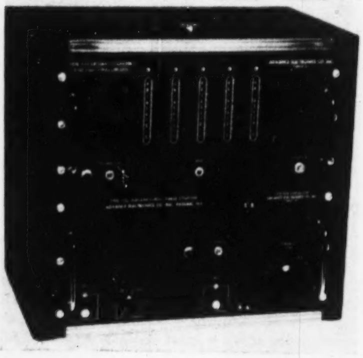
AMPERES
2465

New "Model 40" ammeter, designed especially to indicate low battery charging rates, provides unit values on charge side that are only half those on discharge side; shows 30-amp. discharge and 15-amp. charge. (Other ranges available).—*Rochester Mfg. Co., 100 Rockwood St., Rochester 10, N. Y.*

For more information circle **551** on inquiry card.

ULF Phase Counter

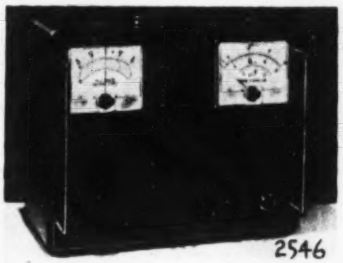
New "Ultra-Low Frequency Phase Counter" has frequency range from 0.0001 to 1000 cps.; comprises a decade counter and switching circuit; a timing unit; and a function unit. Number displayed by counter corresponds to unknown phase angle. In addition, function unit can be easily pulled out and changed to another for converting instrument to a frequency counter, a time interval counter, or a universal time interval and frequency counter. —*Advance Electronics Co., Inc., 451 Highland Ave., Passaic, N. J.*



For more information circle **552** on inquiry card.

Noise Generator

New "Model 755 Universal Noise Generator," for measurement of noise factor in any receiver, is said to be "the first noise generator completely self-contained with no additional equipment required." It is divided into a VTVM section and a Generator Noise section. It permits extremely low sensitivity measurements. Among features: built-in stand-by position for noise output; noise diodes built into probe whereby output noise is connected directly to receiver input: this eliminates cancelling out capacities to generator.—*The Hickok Electrical Instrument Co.,* 10519 *Dupont Ave., Cleveland* 8, *Ohio.*



For more information circle **553** on inquiry card.

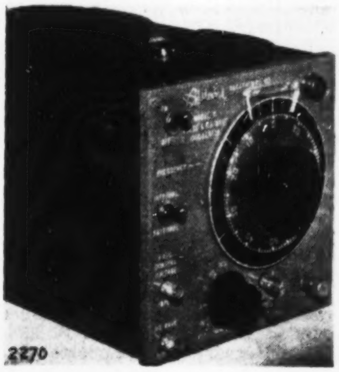
Watt-varmeter

New "Dynamaster Watt-Varmeter" is a wide-strip combination instrument for measuring and recording both power and reactive power on the same two-zone chart. It uses two "Thermoverters" (thermal watt converters) as primary measuring elements: one connected to measure watts; the other used with phase-shifting transformer in potential circuit to measure vars. "Thermoverter" output being linear, chart used is uniformly graduated. Over-all accuracy within 1 percent, sensitivity 0.05 percent. High torque output allows auxiliary functions such as retransmitting slidewires or alarm contacts to be used without affecting accuracy or sensitivity.—*The Bristol Company, Waterbury* 20, *Conn.*

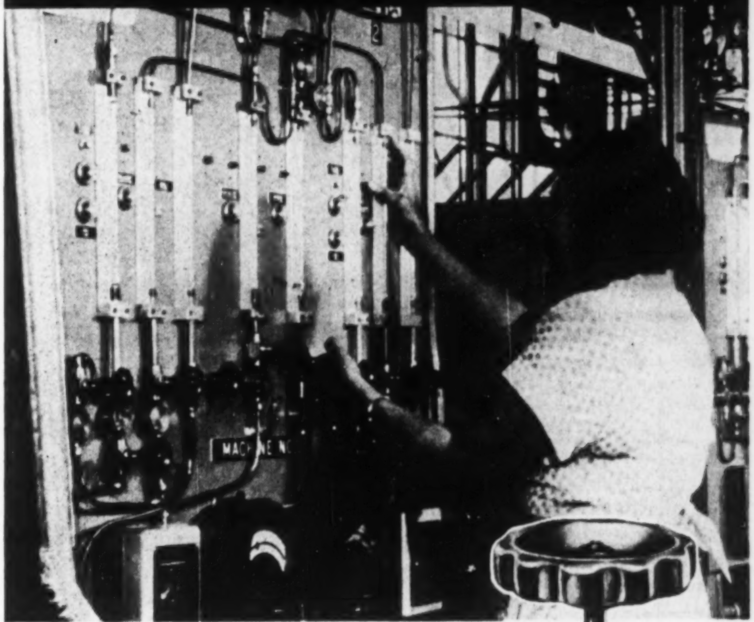
For more information circle **554** on inquiry card.

Pulse and Square-wave Oscillator

New "Model G-1" offers repetition rates variable from 1 to 100,000 pulses per second in five decade ranges; rates controllable by main dial or by an external control voltage; accuracy of 1 percent. Three outputs: positive



HOW TO MAKE PRECISION RESISTORS WITH NEEDLE VALVES



International Resistance Company process development engineers specify Hoke Needle Valves for precision control in Boron-Carbon resistor production

Excellent flow control...ability to meter corrosive gases...rugged...minimum maintenance...reasonable cost.

That's what IRC engineers say about the Hoke valves they're using to make their Boron-Carbon Precistors, vital components of today's complex electronic equipment.

In addition to needle valves, we make packless styles, toggle valves, bar stock types—just about the most complete line of small valves available. We'd like to help with your valve problems.

Write for complete information.

HOKE

HOKE INCORPORATED
Fluid Control Specialists
231 S. DEAN ST., ENGLEWOOD, N. J.

For more information circle **108** on inquiry card.

a new achievement in fast-print oscilloscope recording . . .

Simple to Operate. Uses standard Polaroid* magazine and fast self-developing film. Delivers finished black field print in **60 seconds.** **Automatically Records** 3 to 16 traces per print. Provides full size image on 3" scope, half-size image on 5" scope. No reversal of image.

The Aremac Automatic

RECORDOSCOPE 1185

A fully automatic oscilloscope camera that reduces engineering time and costs . . . improves results.

Sturdy Camera Mount with swing-a-way adapter hood.
Camera easily swung aside when not in use.
Provision for data card exposure.
Versatile . . . one camera can service several 3" and 5" scopes of different makes when provided with adapter mounts and hoods.
Can be interchanged in seconds.
Exposure plus automatic movement to next trace position can be accomplished in three ways: (1) manual shutter release; (2) cable release; (3) remote operating switch.

Manual

RECORDOSCOPE

The manually operated version of the RECORDOSCOPE 1185 offers many of the precision engineered advantages found in the companion automatic model. Though basically designed for manual release and advance of film, this camera can be factory modified for automatic operation.

*POLAROID is the registered name of the Polaroid Corporation

The Aremac

RECORDOSCOPE 1073

a 35 MM Synchronous Camera for Continuous Motion or Single Frame Oscilloscope Recording

The Aremac 1073 Recordoscope is a compact self-contained unit mounting an f/2 six-element 50 mm lens and special 400 foot Aremac powered magazine. Shutter interlock system prevents film motion when shutter is closed. Synchronous film speeds range from 256"/sec. to 1/8"/sec. in 12 steps of 2:1 ratio. The camera can be stopped and restarted with practically instantaneous speed synchronization. Periscope mounts camera vertically. Provision for automatically illuminated data cards and strobe contacts.

Write for Complete Technical Data on AREMAC Cameras Today.

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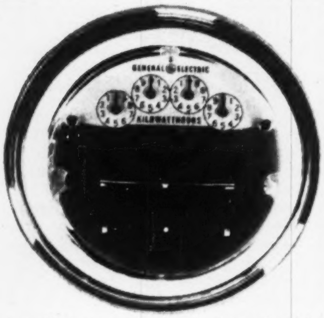
For more information circle **109** on inquiry card.

and negative pulses of 0.2-usec. width and 30-v. amplitude are simultaneously available, together with a square wave of 75-v. amplitude.—*Rutherford Electronics Co., 3707 S. Robertson Blvd., Culver City, Calif.*

For more information circle **555** on inquiry card.

Watthour Meter

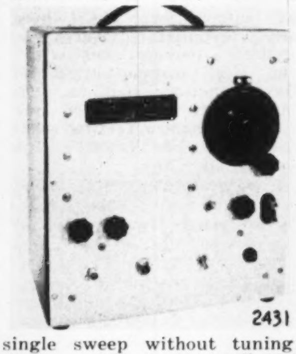
New 2.5-amp. "I-50" transformer-rated watthour meter for single-phase applications where small commercial loads are used provides (in conjunction with proper current and potential transformers) straight-line accuracy over a 400-percent metering range; is available in 120 and 240-volt ratings.—*Meter and Instrument Dep't, General Electric Co., West Lynn 3, Mass.*



For more information circle **556** on inquiry card.

Sweep Generator

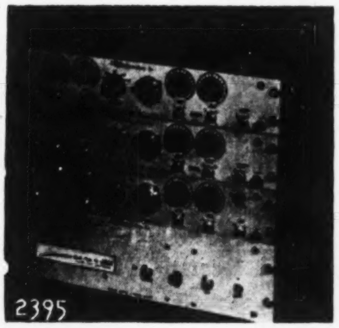
New "type 2144" sweep generator is said to have unique feature of covering its complete frequency range in a single sweep without tuning; is available as "Type 2144-01" 225-420 Mc., "2144-02" 470-890 Mc. and "Type 2144-03" 850-1275 Mc. Self-contained passive marker is calibrated in 5-Mc. steps. Reference base line obtained by retrace blanking; 50-ohm output impedance; source VSWR of 1.25:1 or less; amplitude linearity constant within 1 db; power output 10 mw.—*Kollsman Instrument Corp., 80-08 45th Ave., Elmhurst, N. Y.*



For more information circle **557** on inquiry card.

Pulse Generator

New "Model 2315A Dual Time Delay and Gate Generator" comprises three semi-independent units and a power supply, allowing use as a generator of a variably-delayed variable-width pulse, or of two variable-width



2395

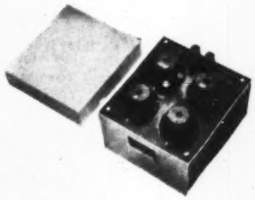
pulses with no delay, or of two variably-delayed blocking oscillator pulses whose delays may be paralleled or cascaded from the sync pulse.—*Electro-Pulse, Inc., 11811 Major St., Culver City, Calif.*

For more information circle **558** on inquiry card.

ELECTRICAL-INSTRUMENT ACCESSORIES

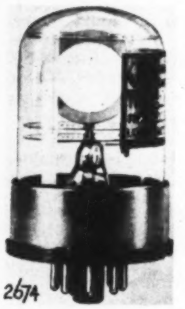
Resistance Decade Boxes

New line of decade boxes combine 0.1 percent accuracy with highly compact construction. Illustrated is 4-dial decade box which occupies 5⅞ x 6⅜ in. of desk or shelf space. Available: 27 models to cover from one ohm to 110 megohms.—*The Winslow Co., 9 Liberty St., Newark 2, N. J.*



For more information circle **559** on inquiry card.

Frequency Crystal



2674

New "G-12A Glasline" precision quartz crystal, when recently tested by a U.S. Government laboratory, varied in frequency less than one part in one hundred million when measured continuously for two weeks (a rate of change of less than one second in more than three years).—*James Knights Co., Sandwich, Ill.*

For more information circle **560** on inquiry card.

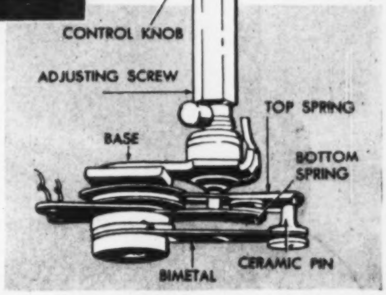
Crystal Oven

New "JK09" mass-produced oven, said to equal performance of ovens employing multistage heaters and massive heat retaining elements, measures 1.28 in. dia. by 1.70 in. high; weighs 1.5 oz.; yet will meet specification as extreme as 75±1 C. in range of −55 to 70 C. Among other features: minimum temperature gra-

HOW CHACE THERMOSTATIC BIMETAL ACTUATES and CONTROLS THE Cook-N-Fryer

WESTINGHOUSE

A Product of Westinghouse Appliance Division
Mansfield, Ohio



The new Cook-N-Fryer recently announced by Westinghouse, demonstrates another typical use of Chace Thermostatic Bimetal for actuating and controlling cooking appliances. The thermostat is the well-known Unitherm, variations of which are used in a number of Westinghouse Appliances.

The operating principle is reliable and time-proven. The control knob is mounted on the hexagonal shaft in a horizontal position. When the knob is set to the desired temperature, the thermostat top spring is a fixed distance from the bimetal pin. As the appliance heats, the bimetal element deflects upward until the ceramic pin engages the top spring and opens the circuit. Cooling then begins, the thermostat re-closes and once again the appliance begins to heat. It is this successive heating and cooling of the thermostat and the subsequent opening and closing of the appliance heating circuit that maintains the Westinghouse Cook-N-Fryer at the proper cooking temperature.

Manufacturers of heat responsive devices all over the country are specifying Chace Thermostatic Bimetal for control, indication and protection of costly equipment. We furnish our 29 types in strip, random length rolls or in completely fabricated elements or assemblies to your specification. Write today for your copy of "Successful Applications of Chace Thermostatic Bimetal", a handbook of engineering data. Or call on our application engineers before proceeding with your new design.

IT BENDS WITH THE HEAT

W. M. CHACE CO.
Thermostatic Bimetal
1609 BEARD AVE., DETROIT 9, MICH.

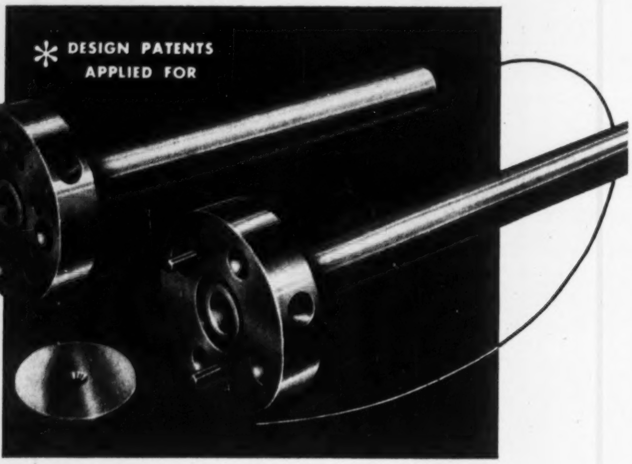
For more information circle **110** on inquiry card.

NEW...*

DANIEL

ORIFICE FLOW SECTIONS

for MODERN INSTRUMENTATION



Specially designed for accurate . . . low cost . . . small flow measurement in line sizes from ¼" through 1½". *Precision honed tubes,* held to extremely close tolerances, assure uniform line size and internal finish. Light weight flanges have dowel pins for positive alignment and centering of the orifice plate. Tap holes can be rotated for convenient installation. Manufactured in stainless steel for corosion resistance and non-contamination. Also in carbon steel.

STAINLESS STEEL "SIMPLEX"
ORIFICE FLOW SECTIONS

Line sizes 1½" through 6". These flow sections incorporate the Daniel Simplex Orifice Plate Holder which provides a fast, easy method for changing orifice plates. Tubes are honed for uniform line size and internal finish. Available in stainless steel or carbon steel.

Write for full engineering data on these Flow Sections.
See them at the ISA Show, Daniel Booth No. 223.

DANIEL ORIFICE FITTING COMPANY

3352 UNION PACIFIC AVENUE
LOS ANGELES 23, CALIFORNIA

5405 CLINTON DRIVE
HOUSTON 20, TEXAS

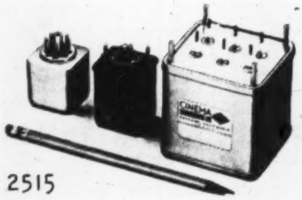
For more information circle **111** on inquiry card.

dient at crystal, rapid warm-up with no over-shoot, and close control over a wide ambient temperature range with low cycling deviation. Oven houses one or two "JK H-17" crystals, plugs into an octal tube socket, is available with a choice of heater voltage of 6 to 28.—*James Knights Co., Sandwich, Illinois.*

For more information circle **561** on inquiry card.

Sealed Resistive Networks

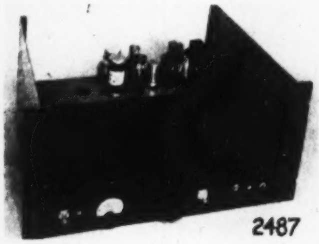
New hermetically-sealed resistive networks, embedded in epoxy plastic, are offered in a large number of terminal-types, including plug-in and low- and high-voltage insulator type, are available in resistances from 0.1 ohm to 15 megohms.—*Cinema Engineering Co. Div., Aerovox Corp.,* 1100 *Chestnut St., Burbank, Calif.*


2515

For more information circle **562** on inquiry card.

Bolometer Preamplifier

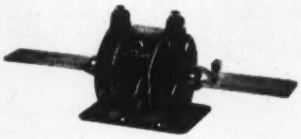
New "Model BA-1," for precision measurement of power ratios in frequency range from 20 to 10,700 Mc., features input noise below 30 millimicrovolts when operated with a 200-ohm bolometer; and linearity better than 0.1 db at 400 and 1,000 cps.—*Weinschel Engineering Co., Inc.,* 10503 *Metropolitan Ave., Kensington, Md.*


2487

For more information circle **563** on inquiry card.

Instrument Transformer

New "Type JCA-0" butyl-molded miniature current transformer, featuring both window-type and bar-primary construction, is designed for operating meters and instruments; can be used on either single-phase two-wire or polyphase circuits; is suitable for use on any circuit of 600 volts or below. Two current ratings: 200:5 and 400:5 amps.—*Meter and Instrument Dep't, General Electric Co., West Lynn 3, Mass.*



For more information circle **564** on inquiry card.

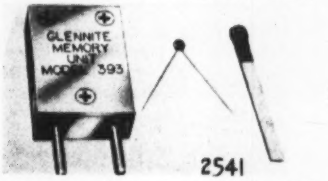
Sine-wave Generator

New "KD-1 Oscillator" provides essentially pure highly-stable sine-wave power for lab use and production testing. Virtual absence of harmonics makes it an ideal tone source for bridges, amplifier testing, etc. Zero impedance characteristic is useful in strain-gage and other measurements. Amplitude stability under difficult line and load conditions make it an excellent source of a.c. for magnetic amplifiers and precise measurements at simulated line frequencies.—*The Nuclid Corp., 45 W. Union St., Pasadena 1, Calif.*

For more information circle **565** on inquiry card.

Memory Unit

New "Model 393" potted crystal memory unit operates on pulses as short as 0.1 usec. Efficient storage and recovery level 50 to 100 volts; significant storage as low as 30 volts. —*Glenco Corp., Metuchen, N. J.*



2541

For more information circle **566** on inquiry card.

Balanced Modulator for Pulse Applications

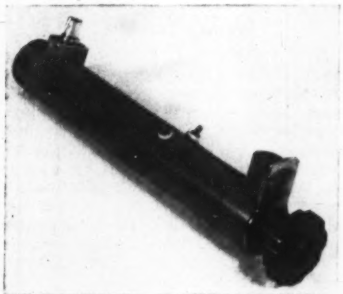
New "Type 1000-P7 Balanced Modulator" has a modulation-frequency response flat from d.c. to 20 Mc. Usable carrier-frequency range 60 to 2300 Mc. Throughout this carrier range, 100-percent AM, double-sideband suppressed-carrier modulation, and pulse modulation with 60-db carrier suppression between pulses are also possible.—*General Radio Co., Cambridge 39, Mass.*

2406

For more information circle **567** on inquiry card.

Cavity Oscillator

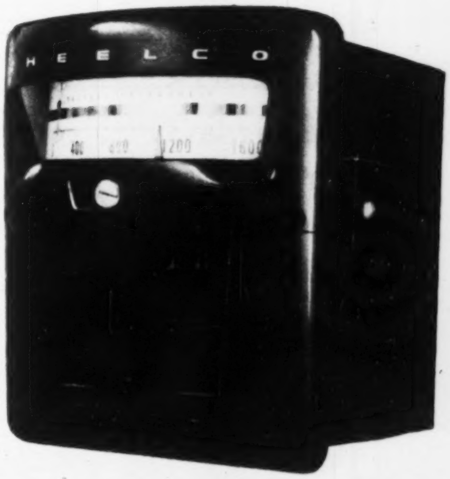
New "No. 192A Rocket Tube Cavity Oscillator," for microwave signal generation is 8 in. long; employs Sylvania UHF planar triode tube to provide a stable r-f. signal source in both a CW and a pulse model; can be supplied

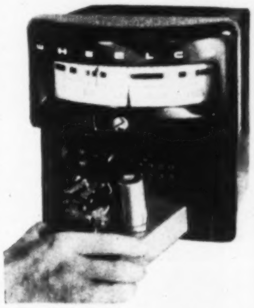


BARBER COLMAN

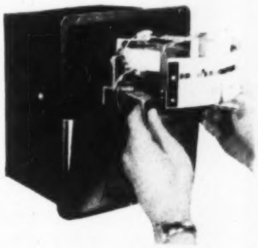
NEW Wheelco 400 Series Capacitrol

Ultra-sensitive
"Plug-in" design
Attractive styling
Larger scale
New flexibility





"Plug-in" design of control chassis permits quick removal for servicing and on-the-job modification to meet changing production demands.



"Plug-in" measuring system is ruggedly constructed to give long, trouble-free service under severe operating conditions.

If your problem is to maintain continuous linear relationship between a controlled variable and fuel input, this new Wheelco Model 405 Capacitrol will give you ultra-sensitive "no-drift" control plus extra moneysaving benefits. With fully "plug-in" design, it's easy to inspect and service. Large, 6" calibrated scale eliminates parallax errors in reading. Convenient tuning adjustment. Compensates automatically for variations in cold junction temperatures. Unusually stable with respect to voltage fluctuations and ambient temperature changes. Automatic thermocouple break protection. Built to exacting standards for accuracy, reliability and long, trouble-free life. Write for Bulletin F-6314.

WHEELCO INSTRUMENTS DIVISION

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For more information circle **112** on inquiry card.

YOU PYROMETRY WIZARDS GOING TO THE ISA SHOW?

T-E'S GOT 4 NEW INSTRUMENTS TO SHOW YOU.

The time: September 13th to 24th
The place: Convention Hall, Philadelphia
And here's what you can see
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Instruments

- **NEW** Temperature monitoring system
- **NEW** Recording controller
  - —potentiometer and resistance bulb types
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  - —potentiometer and resistance bulb types
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IN CANADA—THERMO ELECTRIC (Canada) Ltd., BRAMPTON, ONTARIO

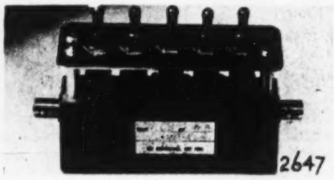
For more information circle **113** on inquiry card.

as a cavity alone, 4 in. long; is available at frequencies from 1000 to 4000 Mc. with a tuning range of 400 Mc. Root counter for calibration.—*Amerac, Inc., 116 Topsfield Rd., Wenham, Mass.*

For more information circle **568** on inquiry card.

Decade Delay Line

New "Model 2353" panel-mounting decade delay line provides adjustable delay in steps of 0.05 usec. to a maximum of 1.15 usec. Characteristic impedance 72 ohms; pulse rise time 0.13 usec. after total delay of 1.15 usec.; nominal delay tolerance 3 percent; input and output connections through BNC jacks; unit sealed with network embedded in epoxy resin.—*ESC Corp., 578 E. 161st St., New York 56, N. Y.*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For more information circle **569** on inquiry card.

Variable Delay Lines

New "Model RVDL 650-0.7" series of single turn continuous variable delay lines provide a continuously variable time delay of zero to 0.7 usec. with a rise time of 0.1 usec. With an attenuation of 10 percent, band-width at full delay is 4 Mc. Lines are designed to meet military environmental requirements and withstand normal shock and vibration. A line of 650-ohms nominal characteristic impedance is available for immediate shipment.—*PCA Electronics, Inc., 2180 Colorado Ave., Santa Monica, Calif.*

For more information circle **570** on inquiry card.

Variable Delay Line

"Model V-104 Delay Line" provides a variable delay of 0 to 1.2 usec. to applied waveforms, obtained with a lumped-constant circuit consisting of 60 coil and capacitor sections (delay of each section is 0.02 usec.). A 60-contact rotary switch taps line at desired delay. An incremental delay of 0.01 usec. is obtained with switch in shorted position, thus providing 120 steps. Rise time varies with delay from less than 0.02 usec. to approx. 0.04 usec. Nominal impedance 2700 ohms. —*Control Electronics Co. Inc., 1925 New York Ave., Huntington Station, N. Y.*

For more information circle **571** on inquiry card.

Delay Lines

New Miniature Distributed Constant Delay Lines are said to be of "revolutionary new designs" and almost half size of previous designs. Impedance range 500 to 2000 ohms (standard 50- and 100-ohm lines still available in their original sizes); delay time 0.1 to 1.0 usec.; attenuation, in most cases, less than 10 percent. All meet MIL-T-27. In most cases, small quantities immediate shipment. —*PCA Electronics Inc., 2180 Colorado Ave., Santa Monica, Calif.*

For more information circle **572** on inquiry card.

Delay Lines

New miniature designs have been added to maker's standard delay lines: now a complete range of miniature lumped constant delay lines. Among functions: delaying trigger pulses; pulse-forming networks; pulse-width discrimination. Standard impedance range 25 to 3000 ohms; time delay 0.05 to 10 usec.; rise time 0.03 to 0.5 usec.; maximum attenuation 20 percent; maximum pulse voltage 3000 volts. All meet MIL-T-27. Quick delivery.—*Neutronics, Inc., 2908 Nebraska Ave., Santa Monica, Calif.*

For more information circle **573** on inquiry card.

POWER SUPPLIES

D-c. and Filament Supplies

New "Model 1" delivers 200 to 335 v.dc. for loads to 100 ma.; features electronic regulation to better than 1 percent to full-load and line voltage variations from 105 to 125. Ripple less than 10 mv. rms. Filament supply is an isolated output of 3 amps. at 6.3 v.ac.—*Associated Specialties Co., 1751 Main St., Orefield, Penna.*

2607

For more information circle **574** on inquiry card.

D-c. Supplies for Transistors

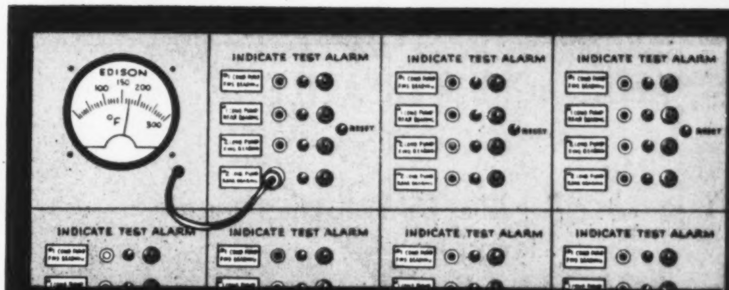
Two new closely-regulated d-c. tube type power supplies are specially designed for powering transistors. "Model T-100-B" is a meter-equipped regulated dual voltage power supply with two duplicate outputs, each having three ranges: positive or negative 0-1/10/100 volts; adjustment by decade switches and voltage dividers; max. direct current output 100 ma. "Model T-100-D" provides same output ranges but adjustment is by direct-reading decade switches in 0.1-v. steps with 0.1 percent accuracy. Both are for rack panel mounting and include dust cover and removable end plates.—*Dressen-Barnes Corp., 250 N. Vinedo Ave., Pasadena 8, Calif.*

For more information circle **575** on inquiry card.

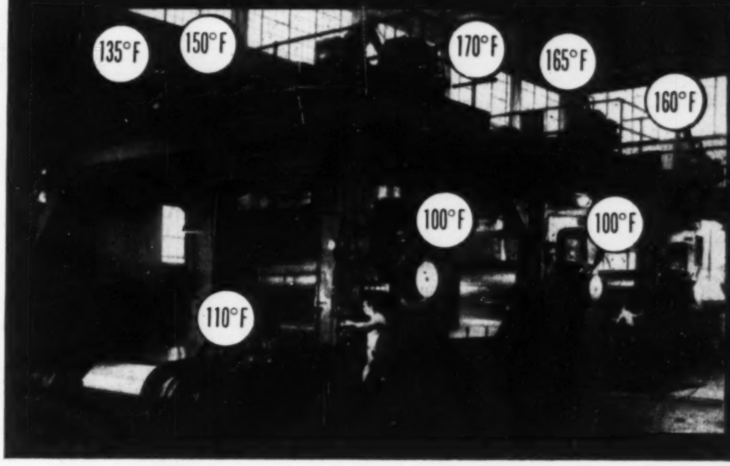
Variable-frequency Supply

New variable frequency power package covers frequency range from 380 to 420 cps.; rated at 1½ kva, pow-

2201



Edison's NEW Omniguard Pinpoints "Hot" Points



OMNIGUARD — simplest and most flexible temperature monitoring system yet devised — safeguards industry. Wherever power is generated . . . wherever chemical processes are in motion . . . wherever machinery is in operation, **OMNIGUARD**, with unique "building-block" construction, pinpoints the vital "hot" points reached by Edison resistance temperature detectors.

Designed and developed at the world-famous Edison Laboratory, only **OMNIGUARD** has these new, *exclusive* features:

- **▶ Constant protection** — All points are "on-guard" at all times. Instant alarm the moment critical temperature is reached—*without scanning mechanisms* or codes.
- **▶ Individual alarm point adjustment** — Each point has own alarm setting — can be adjusted on the spot without special tools.
- **▶ Installation adaptability**—Group the units close to protected equipment — or in control room with minimum wiring and at lowest installation cost.
- **▶ Equipment flexibility**— Basic monitor units handle as few as four points. More points can be added at any time. One indicator serves multiple points.
- **▶ Design simplicity** — System monitors without moving parts—nothing to "wear" out. No electronic tubes or complex circuits.

Write us, won't you, for more specific information on *your* heat control problem?

Thomas A. Edison

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For more information circle **114** on inquiry card.

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For more information circle 115 on inquiry card.

er factor 0.9; 3-phase output 115/200 volts held constant by an electronic regulator.—*American Electric Motors, Inc.*, 4811 *Telegraph Road, Los Angeles 22, Calif.*

For more information circle **576** on inquiry card.

Stable-frequency Supplies

Two new frequency-stabilized power supplies are announced. Available on quick delivery schedule is "Model ME/PP-11" (illustrated), a stable 60-cps. 115-or-230-volt source to operate frequency-critical devices requiring up to 200 watts in areas where line frequency is not dependable. In general it consists of three units: high-voltage power supply, 60-cps, generator, and 60-cps. amplifier. ★ "Type M-2027" is a 50-watt supply, in appearance like upper third of 200-watt supply. In general it consists of a Wien bridge oscillator, a phase inverter, an amplifier driver, and a power amplifier.—*Maryland Electronic Mfg. Corp., College Park, Md.*

For more information circle **577** on inquiry card.

Regulated Voltage Source

New "Model VRS15 Tubeless D-c. Voltage Standard," designed primarily for recording equipment (where it eliminates power supply and standard cell) is also available as a lab standard. Output 1.5 v.dc. at 6 ma. Not damaged by short circuit. Accuracy 1 mv. against line; drift in 24 hours well under 1 mv.—*Sorensen & Co., Inc.*, 375 *Fairfield Ave., Stamford, Conn.*

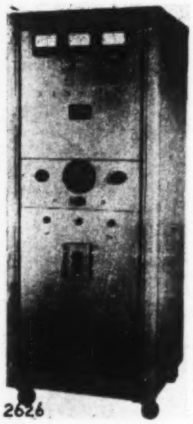
For more information circle **578** on inquiry card.

Regulated D-c. Supplies

New line of "Stavolt" d-c. power rectifiers comprises ten 28-v. models with capacities to 1000 amps.; mobile or stationary types. All units are closely regulated by a unique magnetic amplifier control: no tubes, lamps, carbon piles or varistors. Important size and weight reduction by use of latest core and insulation materials and aluminum construction. All components encapsulated. Weatherproof construction. All units meet MIL-E-7894. — *McColpin-Christie Corp.*, 3410 *W. 67th St., Los Angeles 43, Calif.*

For more information circle **579** on inquiry card.

50-to-6000-cps. Supply


2626

New "Model 1425 Electronic Generator," useful as a power source in testing air-borne equipment, servo systems, etc., has four frequency ranges covering from 50 to 6,000 cps.; delivers 900 va. from 80 to 135 volts or 160 to 270 volts. Voltage regulation from no-load to full-load is within 2 percent.—*Communication Measurements Lab., Inc.*, 350 *Leland Ave., Plainfield, N. J.*

For more information circle **580** on inquiry card.

Voltage Regulator

New "Regavolt" is a plug-in unit intended to operate from output of filter of any convential d-c. power supply; converts it to a well-regulated unit: regulation within 0.3 percent and a ripple within 0.002 percent. Maximum output current 225 ma.; maximum regulated current output 125 ma.; size approx. 2½x2¼x5 in. with tubes; standard male octal plug for a base connection.—*Mega Research, P. O. Box* 371, *Dover, N. J.*

For more information circle **581** on inquiry card.

Ground Power Supply for Missiles

New 400-cps. a-c. motor-alternator set, for missile or flight ground power requirements, has solid rubber tired casters, is totally enclosed and protected against weather, contains all necessary controls for plug-in operation including protective relays; has cable storage space. Lifting eyes, handles and tow-bar ease handling and movement.—*American Electric Motors, Inc.*, 4811 *Telegraph Rd, Los Angeles* 22, *Calif.*

For more information circle **582** on inquiry card.

Close-regulation Supplies

New "Model UHR-220" is said to feature "ultra-high regulation over the entire operating range under all

Compare *the superior performance and construction of the I.I.C. Flow Meter*

1. BELLOWS—Seamless, no welds. Type 316 stainless steel or Monel.

2. BEARING—Exclusive, free-floating, non-freezing bearing — a product of I.I.C. research and development.

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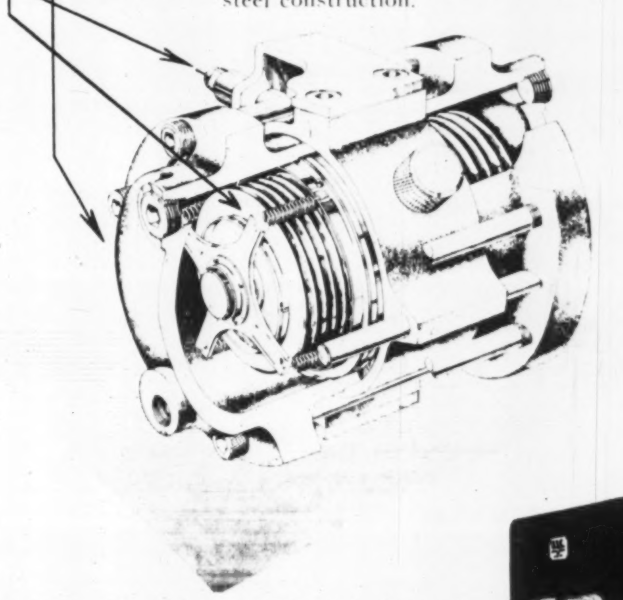

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Model 802 Recorder
(Patents Pending)

Model 800-6 Indicator
(Patents Pending)

Write for Bulletin 56-B

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For more information circle **116** on inquiry card.

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We are looking for outstanding creative and inventive engineers who are capable of heading projects in the Development Laboratory of Servo-Mechanisms. An M.E. or E.E. degree or better is required with a minimum of five years experience in the industrial control field.

Salary commensurate with your background.

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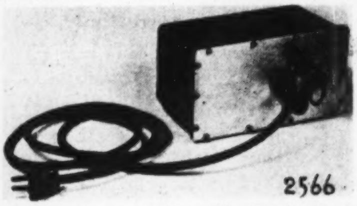
For more information circle **118** on inquiry card.

conditions." It provides 0-200 ma. at 0-500 volts with 0.001 percent regulation and ripple less than 100 microvolts. D-c. impedance less than 0.01 ohm and a-c. impedance less than 0.1 ohm in series with 0.1 microhenry (4 in. of wire). Transient response 0.001 millisecond.—*Krohn-Hite Instrument Co., 580 Massachusetts Ave., Cambridge 39, Mass.*

For more information circle **583** on inquiry card.

H-v. D-c. Supply

New "PS-3" high-voltage d-c. power supply maintains output voltage within 3 percent despite input line fluctuation of 90 to 130 volts or under continuous operation. Photo shows a 20,000-volt 200-microamp. shock-mounted and water-tight unit. All units meet MIL-P-16527 and MIL-16E4.—*Meyer-Opticraft, Inc., 39 W. 60th St., New York 23, N. Y.*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For more information circle **584** on inquiry card.

Calibrated D-c. Supply

2648

New "Model 301B" delivers ½ amp. at any voltage from 5 to 815 v.dc. Three decade switches for selection of output voltages in 1-v. steps; 1.1-v. vernier calibrated in 0.1-v. increments affords resolution of 2 mv. at any output voltage. Regulation 0.002 percent for 20 percent change in line voltage and 0.002 percent from no-load to full-load. Long-term stability 0.01 percent or better.—*John Fluke Mfg. Co., Inc., 1111 W. Nickerson St., Seattle 99, Wash.*

For more information circle **585** on inquiry card.

Nuclear D-c. Power Supply

New "Model 402" delivers 1 ma., 800 to 1600 v.; features selective grounding (polarity of output instantly reversible via front panel switch), regulation 0.03 percent or better for 20 percent change in line voltage and 0.03 percent or better from no-load to full-load.—*John Fluke Mfg. Co., Inc., 1111 W. Nickerson St., Seattle 99, Wash.*

For more information circle **586** on inquiry card.

500-watt Converter

New "No. DR1025C5PX Custom Converter" for hi-fi installations is designed to deliver 125 v.ac. with 120 v.dc. input and a load of 50 watts. Owing to regulation of 500-watt converter, voltage would only drop to about 105 with 110 v.dc. input and full 250 watt load.—*Carter Motor Co., 2644 N. Maplewood Avenue, Chicago 47, Ill.*

For more information circle **587** on inquiry card.

AMPLIFIERS

Magnetic Amplifier

New "Type 2063-01" weighs 15.5 oz.; comprises two stages of vacuum-tube preamplification and a magnetic power output stage; operates from 115-v. 400-cps. source; requires approx. 14 va. at a power factor of 0.7. Input impedance 5,000 ohms; maximum time delay 1/400 sec. In a typical circuit, error signal fed to amplifier is obtained from output winding of a "Synchrotel" and amplified error signal is applied to control phase of an induction motor or motor-driven induction generator.—*Kollsman Instrument Corp., 80-08 45th Ave., Elmhurst, N. Y.*

For more information circle **588** on inquiry card.

Linear Amplifier and Preamplifier

New "Model 218 Linear Amplifier," patterned after latest ORNL models, includes many improvements for added stability in use with nuclear detection devices: control of pulse height discriminator at high level output; better electrostatic shielding of amplifier and discriminator circuits; an additional USE-TEST switch, etc. ★New "Model 219" preamplifier provides added gain necessary for use with ionization chambers or other high-impe-

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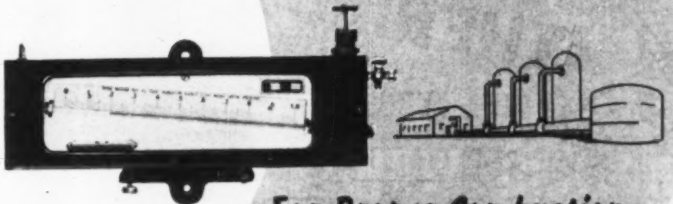

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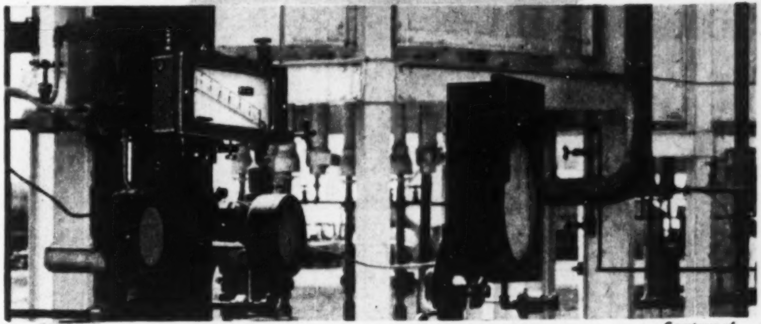

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Courtesy of Oil and Gas Journal

Meriam Draft Gauges with characteristic Meriam Manometer Accuracy, tell operators of Petro-Chemical furnaces in refineries when they have set the most efficient air-gas ratio. This essential information is checked periodically by most operators. These instruments precisely indicate flow at low cost.

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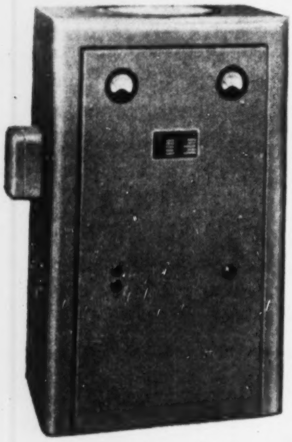

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California

For more information circle 121 on inquiry card.

dance low-level radiation detectors.—*Atomic Instrument Co., 84 Massachusetts Ave., Cambridge 39, Mass.*

For more information circle **589** on inquiry card.

ELECTRICAL AND ELECTRONIC COMPONENTS

Klystron

New "VA-94" is a new Ku-band reflex klystron for airborne applications in 16-to-17-kMc. frequency range. At 300 volts beam potential it provides a minimum of 20 mw. power output and 55 Mc. bandwidth. —*Varian Associates, 611 Hansen Way, Palo Alto, Calif.*

For more information circle **590** on inquiry card.

Industrial Thyratrons

New "Types AX-5544 and AX-5545," specifically designed for electronic control purposes such as d-c. motor speed, counting and sorting devices, etc., are interchangeable in every respect with RETMA tubes bearing same designation. Both are 3-electrode thyratrons with negative control characteristics. Xenon filling allows reliable operation at maxmium ratings over a wide temperature range.—*Amperex Electronic Corp., 230 Duffy Ave., Hicksville, L. I., N. Y.*

For more information circle **591** on inquiry card.

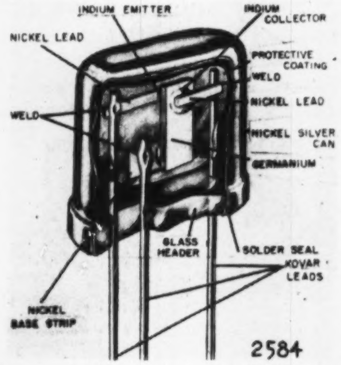
Tetrode Transistors

New hermetically-sealed tetrode grown-junction germanium transistors, especially suitable for use in audio amplifier automatic gain control circuits, have two base layer connections allowing introduction of feedback. Alpha of tetrode through amplifier section is guaranteed to be 0.95 or better. Output signal attenuation of over 20 db can be secured with less than 100 ua. applied to second base lead.—*Texas Instruments Inc., 6000 Lemmon Ave., Dallas 9, Texas.*

For more information circle **592** on inquiry card.

Sealed Junction Transistors

New "Types 2N34, 2N36, 2N37, and 2N38" junction transistors are produced in small sealed metal cases.

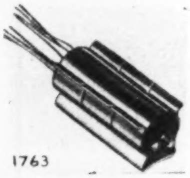


2584

Since over 99 percent of maker's plastic-cased transistors have been performing satisfactorily in field for more than a year, new units are expected to be even more dependable.—*Seletron & Germanium Div., Radio Receptor Co., Inc., 251 W. 19th St., New York 11, N. Y.*

For more information circle **593** on inquiry card.

Subminiature Tube Holder



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New subminiature tube holder made of cadmium-plated spring steel with a silver-plated brass tube shield provides space-saving means for fixing in relation to mounting surface. Tubes withstand high shock as in guided missiles. Electronic equipment using this holder has withstood tests of 10 to 500 cps. from 5 to 20 *G* for 8 hours without resonance. Available in 13 diameters and in lengths to 2 in.—*Atlas E-E Corp., Bedford Airport, Bedford, Mass.*

For more information circle **594** on inquiry card.

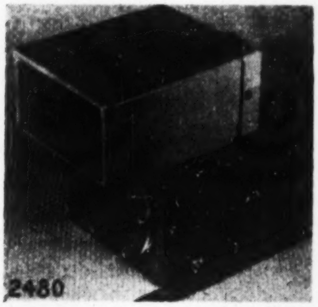
Radar Deflection Yokes

New radar deflection yokes include rotating and stationary types for PPI and rectangular displays: feature high performance core materials and a wide range of inductances using complex winding distributions with high-voltage in ulations.—*Constantine Engineering Labs., Mahwah, N. J.*

For more information circle **595** on inquiry card.

Waveguide Switch

New "Model ASWI-XO1" waveguide switch features: VSWR, 1.05 to 1 maximum; crosstalk, 50 db minimum; actuation time, 0.5 second maximum; VSWR during switching, 1.2 to 1; power handling ability, approx. 0.35 megawatt cw.—*Electronics Div., Thompson Products, Inc.,* 2196 *Clarkwood Rd., Cleveland* 3, *Ohio.*

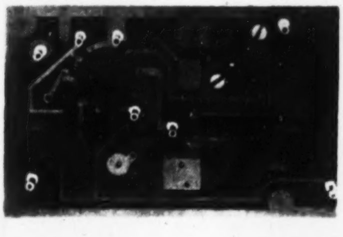


2480

For more information circle **596** on inquiry card.

Etched Circuits

New "Flying M" prefabricated etched circuits, on a metal-clad laminate, minimize weight and space; eliminate human errors. Maker also offers prefabrication services: (1)



Circle **122** on inquiry card →

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PANALARM "50" PLUG-IN UNIT . . . hermetically sealed and most versatile ever developed . . . simply plugs into chassis to expand system . . . no wiring . . . no other connections. Corrosion-proof and suitable for Class I, Div. 2 locations.

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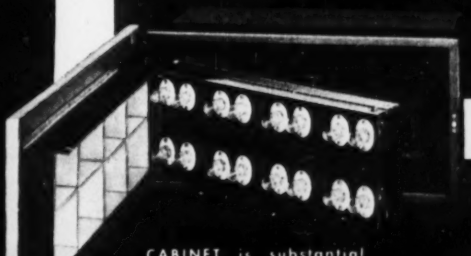

CABINET is substantial gauge steel with sturdy chassis and sub-door arrangement. It is pre-wired ready for installation, yet completely flexible without re-wiring.

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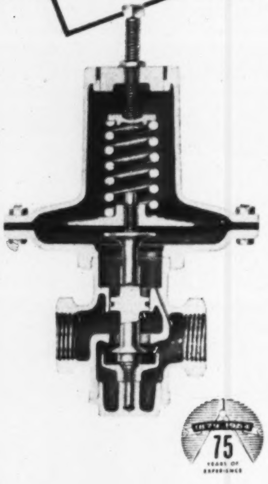

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For more information circle 124 on inquiry card.

solder plating circuit pattern; (2) drilling and punching terminal holes; (3) inserting eyelet connectors; (4) mounting and soldering all components; (5) electrical testing of completed unit.—*Miller Dial & Name Plate Co., 4400 N. Temple City Blvd., El Monte, Calif.*

For more information circle **597** on inquiry card.

Pulse Transformer Kit

New "No. 2 Plug-In Pulse Transformer Kit" contains ten plug-in Hypersil-core transformers to fit a standard 7-pin miniature tube socket. Transformers cover a pulse width range from 0.1 to 23 usec. using 5 two-winding transformers and five three-winding transformers. By varying cathode resistance and circuit bias, large variations in pulse width can be achieved. Also, step-up and step-down ratios can be had by connecting two windings of a 3-winding transformer in series. All units meet MIL-T-27. Immediate delivery.—*PCA Electronics Inc., 2180 Colorado Ave., Santa Monica, Calif.*

For more information circle **598** on inquiry card.

Adjustable Toroid Coils

New "PR" adjustable toroid coils offer a simple and economical means of resonating *LC* circuits. Winding termination is left free for addition or removal of turns. Coils are factory adjusted to within 5 percent of nominal inductance values.—*Hycor Co., Inc., 11423 Vanowen St., N. Hollywood, Calif.*

For more information circle **599** on inquiry card.

Toroidal Inductors

New "Ferroxcube 3C" core inductors are suited to applications requiring small size, wide range of inductance values, high *Q* and high astaticism. Frequency range 5 to 500 kc.; inductance 1.5 millihenries to 4.7 henries; Curie temperature 172 C. (342 F.)—*Mico Instrument Co., 86 Trowbridge St., Cambridge 38, Mass.*

For more information circle **600** on inquiry card.

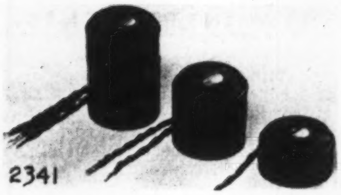
Miniature Inductors

New "Type SL1" miniature inductors are for tuned circuits and filter networks in telemetering, computing, laboratory measuring, and other systems requiring high *Q* in frequency range of 5 to 500 kc. Inductance values from 2.2 to 220 millihenries. Core material Ferroxcube 3C. Unit weighs ¾ oz.—*Mico Instrument Co., 86 Trowbridge St., Cambridge 38, Mass.*

For more information circle **601** on inquiry card.

Toroidal Inductors

New toroid-shaped inductors feature new encasement assembly which simplifies mounting problems. Injection-molded high-impact-strength plastic cup is used in combination with disk and machine screw for containing toroid; screw is used also for holding assembly to chassis. Stacking numerous units for convenience and minia-


2341

turization is accomplished readily because cases interlock. No increase in cost over uncased toroids.—*Torocoil Co., 1374 Mobile Ct., St. Louis 10, Mo.*

For more information circle **602** on inquiry card.

Hi-fi Output Transformer

New "BO-13" high-fidelity output transformer, specially designed for ultra-linear operation, features maker's "sealed-in-steel" construction; has pin-type terminals; is designed with studs for flush chassis mounting. —*Chicago Div., Chicago Standard Transformer Corp.*, 3501 *Addison St., Chicago* 18, *Ill.*

For more information circle **603** on inquiry card.

Small Transformers

New transformers, in sizes 2 va. and larger, are especially suitable for control panels. High-dielectric insulation between winding layers; Polyvinyl-insulated color-coded leads; transformer impregnated with polymerizing type varnish resistant to moisture and acid. All units tested to meet or exceed N.E.M.A. Standards. —*Hevi Duty Electric Co., Milwaukee* 1, *Wis.*

For more information circle **604** on inquiry card.

Instrument Power Supply Transformers

New transformers, specifically designed for use in voltage-regulated power supplies, CRT supplies, preamplifiers, and VTVMs, feature multiple filament windings for use where tubes must operate at different potentials; also have minimum flux-density cores to limit stray magnetic fields (making them suitable for use in extremely sensitive equipment). In addition, multiple static shields minimize capacitive coupling.—*Triad Transformer Corp.*, 4055 *Redwood Ave., Venice, Calif.*

For more information circle **605** on inquiry card.

X-band Flap Attenuator

New flap attenuator is for adjusting power levels and isolating oscillators from pulling effects of variable loads. With a fully-inserted flap it may be employed as a load. It operates in 8,200-12,400-Mc. band. For attenuation values less than 20 db, maximum VSWR is less than 1.15. Simple screw mechanism varies attenuation continuously from 0 to over 30 db. Auxiliary lock offers insurance against variations.—*Guideline Associates*, 47 *State St., Newark, N. J.*

For more information circle **606** on inquiry card.

Variable Attenuators

New "Series V-250 Video Variable Attenuators" are for use not only in TV but also in wide-band amplifiers, pulse amplifiers, nucleonic research, testing, and for use as laboratory standards. Zero insertion loss; con-

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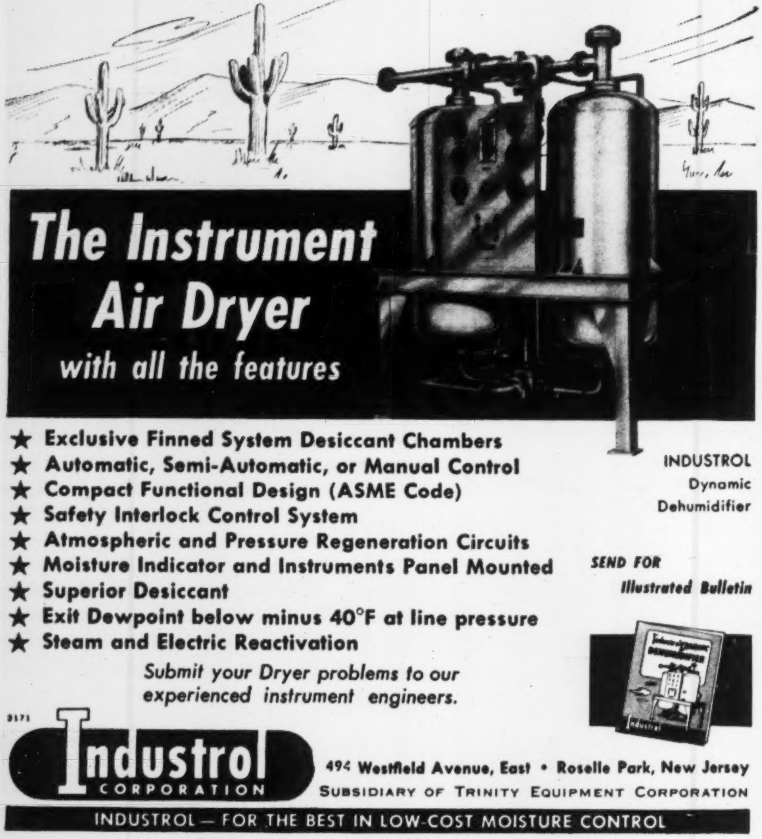
For more information circle 125 on inquiry card.



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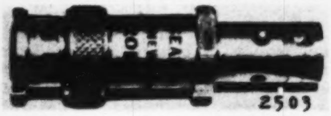
For more information circle **127** on inquiry card.

stant input and output impedance; flat frequency response from 0 to 10 Mc. Available in 10, 20 or 45 steps. Standard lug terminal board or BNC (UG-185/U) connectors.—*Dep't SY, Daven Co., 191 Central Ave., Newark, N. J.*

For more information circle **607** on inquiry card.

Fixed-pad Attenuators

New "HFA-50" and "HFA-75" fixed-pad attenuators (impedances 50 and 75 ohms respectively) are for 0-1000-Mc. range; have maximum VSWR of 1.2 up to 1000 Mc.; use BNC connectors for easy incorporation in most equipment. Accuracy better than 0.5 db.—*Applied Research Inc., 163-07 Depot Rd, Flushing 58, N. Y.*



For more information circle **608** on inquiry card.

Deposited-film Resistor

New "Noblette" deposited-metal-film resistor, measuring 0.160 in. dia. x 15/16 in. long, is available in ½-watt rating; is said to offer excellent stability under high ambient temperatures. Temperature coefficient 0.02 percent per C. degree. Resistance values 1 ohm to 3 megohms in tolerances of 1, 2 and 5 percent.—*Continental Carbon, Inc., 13900 Lorain Ave., Cleveland 11, Ohio.*

For more information circle **609** on inquiry card.

Sub-miniature Resistors

New "Type J Precision Wire Wound Resistors," ¼-in. diam by ¼-in. or ⅜-in. long, feature improved method of terminating winding to wire leads, eliminating serious weak point in most subminiature resistors. Tolerances to 0.05 percent available.—*Resistance Products Co., 714 Race St., Harrisburg, Pa.*

For more information circle **610** on inquiry card.

Miniature Resistors

New "Type EM Precision Wire Wound Resistors" of encapsulated miniature type meet MIL-R-93; range in sizes from 7/16-in. x ⅛-in. to 1¼-in. x ¼-in. and in values from 10 to 30,000 ohms (higher on special order). Tolerances range from 1 percent to 0.01 percent, full wattage to 350 F. Temperature coefficient 0.00002 per C. degree; low thermal emf.—*Electronics Div., Eastman Pacific Co., 2320 E. 8th St., Los Angeles 21, Calif.*

For more information circle **611** on inquiry card.

Miniature Resistors

New "Type HFR" ¼-watt high-frequency miniature resistors exceed MIL-R-10683A. They are solid ceramic rods to which a thin resistive film is permanently bonded; entire body assembly including lead "caps" has moisture-resistant protective coating. Body length 9/16 in., body diameter (over caps) 3/32 in., axial lead length 1½ in.—*International Resistance Co. 401 N. Broad St., Philadelphia 8, Pa.*

For more information circle **612** on inquiry card.

Variable Resistor

New "Type LR6" low-cost tab-mounting variable resistor featuring a Bakelite shaft adjustable from either side of control has a slotted hexangular shaft extending from front, making it easy to adjust control by hand, 7/32 hex nut driver, or screwdriver. Rear portion of Bakelite shaft is round with a screwdriver slot and projects slightly beyond cover of control. Despite small size (0.894 in. diam.), units dissipate 0.5 watt.—*Electronic Components Div., Stackpole Carbon Co., St. Marys, Pa.*

For more information circle **613** on inquiry card.

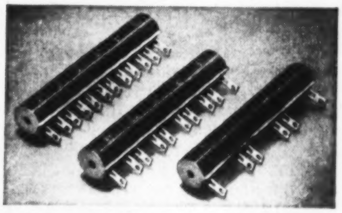
Three-turn VDR

New 3-turn "Series 930 Micropots" are said to provide flexibility of application obviating need for special designs. Either or both mechanical stops may be used as phasing points because of adjustability of the new contact drive assembly. This adjustable feature also provides greater accuracy in four basic types if linearity without modification of units, which are available in standard models from one to five gang, each model produced with single or double shaft and with servo or bushing mount at either or both ends.—*Borg Equipment Div., The George W. Borg Corp., Janesville, Wis.*

For more information circle **614** on inquiry card.

"Grouped" Resistors

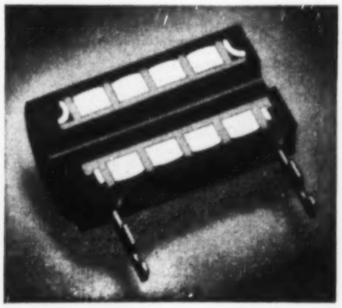
New "Grouped Type" units of "Riteohm" encapsulated precision resistors are made up of two to six lug-type resistors arranged end-to-end in a one-piece molded resin body. Individual resistors in group come in wattages of ¼, ½, and 1; resistance values up to 1,950,000 ohms; tolerances as close as 0.1 percent.—*Ohmite Mfg. Co., 3664 Howard St., Skokie, Illinois.*



For more information circle **615** on inquiry card.

Encapsulated Resistors

New "Riteohm" encapsulated wire-wound precision resistors, exceed requirements of MIL-R-93A, Amend-



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For more information circle **128** on inquiry card.

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ment 2, at 125 C. ambient; are available with axial leads or lug terminals; 0.25 to 1 watt (125 C. ambient); resistance values up to 1,950,000 ohms; tolerances as close as 0.1 percent.—*Ohmite Mfg. Co., 3664 Howard St., Skokie, Illinois.*

For more information circle **616** on inquiry card.

Miniature Resistor

2670
Actual size

New hermetically-sealed wire-wound resistor made to customers' specifications is available in standard sizes down to ¼ x ¼ in. Operating temperatures −55 C. to 125 C. Resistance change with time is less than one-third tolerance.—*I-T-E Circuit Breaker Co., 19th & Hamilton Sts., Philadelphia 30, Pa.*

For more information circle **617** on inquiry card.

Ceramic-case Resistor

New "Type CPC" ceramic-case version of "Carbofilm" precision resistor is housed in a ceramic tube with metallized ceramic end-seals for hermetic sealing. No capacitance effect between element and casing; longest leakage path is provided. Insulated resistor can be squeezed in among other components and against metal surfaces without electrical complications. Units withstand extreme humidity and heat; available in ½, 1 and 2 watt sizes.—*Hi-Q Div., Aerovox Corp., Olean, N. Y.*

For more information circle **618** on inquiry card.

Electrolytic Capacitors

New electrolytic capacitors comprise three main lines: (1) "Unecap" wax-impregnated cardboard-tube with a mounting strap; insulated, flexible, color-coated leads, striped for easy soldering; good for 80-deg. "C" operation; made in single, dual, triple and quadruple combinations. (2) "Super Cap" hermetically-sealed unit in an aluminum can with an insulating sleeve; marked for easy identification. (3) "Twist Prong Can" hermetically-sealed aluminum-grounded cans; available in 1-in. and 1⅜ in. dia. in single, dual, triple and quadruple units.—*United Electronic Mfg. Corp., 542 Thirty-Ninth St., Union City, N. J.*

For more information circle **619** on inquiry card.

Ceramic-type Capacitors

New "Series HP" transmitting or industrial high-power high-current capacitors serve functions heretofore limited to mica types. Originally a French development, used for years in Europe and in Indo-China. Avail-

able in disk ("double-saucer") and cylindrical ("tubular") ceramic dielectric bodies; space and weight reductions from 50 to 90 percent less than corresponding mica units.—*Special Products Div., Aerovox Corp., New Bedford, Mass.*

For more information circle **620** on inquiry card.

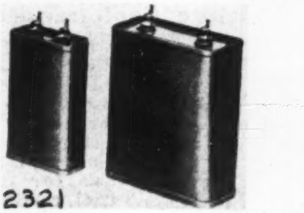
Close-tolerance Capacitors

New "Type MH" hermetically-sealed tubular capacitors are available in any value from 0.01 to 1 uf. with tolerances of 5, 2 and 1 percent on a delivery schedule comparable to "standard-values only" deliveries. Voltage ratings 200, 400 and 600 v.dc.; production tested 250 percent of rated voltage at 25 C. between terminals and between terminals and case. Absolutely no de-rating between -20 and 125 C.—*Dep't Z, Electronic Fabricators, Inc.*, 682 *Broadway, New York* 12, *N. Y.*

For more information circle **621** on inquiry card.

Oil-Filled Capacitors

New series of square and rectangular type capacitors includes many case sizes; working voltage from 600 to 6000 v.dc. Temperature range for Indco oil-filled units, -40 to 70 C.; Pyroteen, -70 to +90 C. Wax impregnation also available. —*Dep't IXP, Industrial Condenser Corp.*, 3243 *N. California Ave., Chicago* 18, *Ill.*



2321

For more information circle **622** on inquiry card.

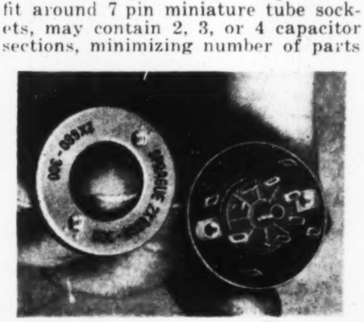
Vitreous-porcelain Capacitors

New "CV-15" capacitors, available in experimental quantities, are formed of silver electrodes embedded in porcelain enamel block. Leads are radial, fused into insulated case. Capacitance ranges 5 to 470 uuf.; capacitance drift less than 0.05 percent over ambient temperatures from -55 C. to 200 C.: essentially absolute retrace. Dissipation factor 0.0003.—*Vitramon, Inc., Box* 544, *Bridgeport* 1, *Conn.*

For more information circle **623** on inquiry card.

Ring Ceramic Capacitors

New "Ring Ceramic Capacitors" fit around 7 pin miniature tube sockets, may contain 2, 3, or 4 capacitor sections, minimizing number of parts



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For more information circle **131** on inquiry card.

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Ammonium Phosphate
Ammonium Sulphate
Amyl Acetate
Anhydrous Ammonia
Aqueous Ammonia
Arsenic Acid
Butyl Acetate
Calcium Bisulphite
Carbolic Acid
Cellosolve Acetate
Copper Nitrate
Copper Sulphate
Cresol
Cresylic Acid
Iso-Propyl Acetate
Lactic Acid
Napthenic Acid
Resin Alkyd
Stearic Acid
Tannic Acid

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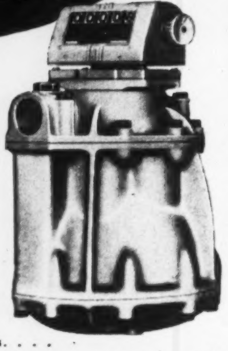
For more information circle 132 on inquiry card.



Another Recording Problem Solved by

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SEGMENTAL RECORDING CHART

Six records are made across the face of this Segmental Recording Chart. And, there are 24 separately numbered segments in one 12 foot loop giving a total of 144 variables recorded at higher speed and with greater readability than ever before. It was developed cooperatively with engineers of E. I. DuPont de Nemours Co., Inc.

So many recording techniques have been brought into use by both industry and instrument makers, that Technical has developed an engineering staff to handle the "Special" charts required. Standard instruments recording under unusual process conditions, too, need "Special" charts. Whatever your chart problem — call Technical Charts, Inc.

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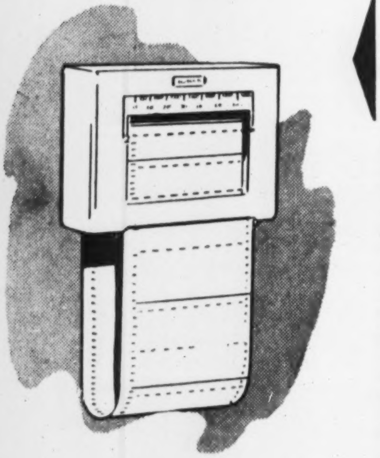


handled on production line. Excellent VHF performance is said to result from zero ground lead length between capacitor sections and tube socket lugs. Voltage ratings from 100 to 500 v.dc. depending on capacitance rating.—*Sprague Electric Company, 43 Marshall St., North Adams, Mass.*

For more information circle **624** on inquiry card.

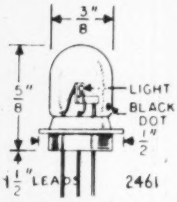
Ceramic Disk Capacitors

New "Series ACD" ceramic disk capacitors for a-c. operation have thicker dielectric and other heavy-duty features to take care of voltage peaks; adequately meet Underwriter's Laboratories requirements (withstand a 1500 v.ac. 60 cps. 1-minute test). Initial leakage resistance better than 7500 megohms; greater than 1000 megohms after humidity.—*Hi-Q Div., Aerovox Corp., Olean, N. Y.*

For more information circle **625** on inquiry card.

PHOTOELECTRIC COMPONENTS

Miniature Phototransistor

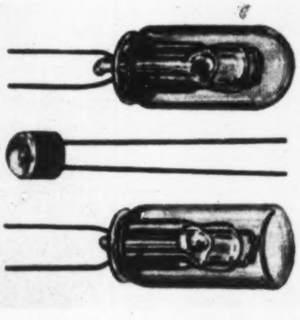


New "Type RR66" miniature *p-n-p* phototransistor, developed for use in automobile headlight dimmers, is available for industrial control applications. Spectral response covers visible range and extends far into infrared so that it is especially useful in black light applications. An available base connection permits thermal stabilization in modulated light applications.—*Seletron & Germanium Div., Radio Receptor Co., Inc., 251 W. 19th St., New York 11, N. Y.*

For more information circle **626** on inquiry card.

Subminiature Photocells

New low-cost and extremely small cadmium sulphide crystal photocells deliver 2 to 5 ma. under 50 to 100 foot-candles with approx. 100 v. across cell and load. Speed of response is about 1/100th sec. at 50 foot-candles. Units respond to visible light, ultraviolet, x-rays, and nuclear radiations. Resistance decreases linearly with increase in illumination.—*Standard Piezo Co., Carlisle, Penna.*



For more information circle **627** on inquiry card.

Germanium Phototransistors

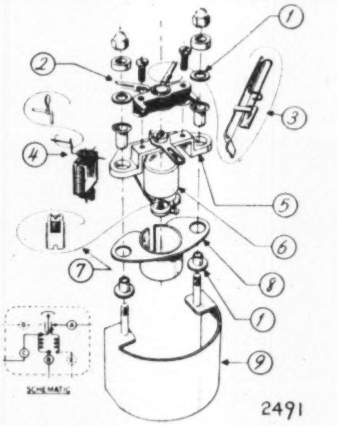
New "Type 800" phototransistors, performing a phototube's functions with advantages of smaller power demand, space and weight, are *n-p-n* grown junction germanium transistors manufactured with glass-to-metal hermetic seals. They operate essentially as grounded emitter transistor amplifiers, displaying great sensitivity to direction as well as intensity of light received through optical-glass window.—*Texas Instruments Inc., 6000 Lemmon Ave., Dallas 9, Texas.*

For more information circle **628** on inquiry card.

ELECTROMECHANICAL COMPONENTS

Supersensitive Relay

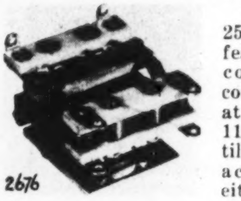
New "VHS" (very high sensitivity) relay is of balanced-armature permanent-magnet type, internally shock-mounted. Sensitivity continuously variable from 0.2 uamp. to 10 amps. or 0.1 mv. to 500 v. Trip point accuracy 1 percent; differential less than 1 percent; repeatability better than 1 percent. Response: 50 per second to 5-sec. time delay.—*Assembly Products, Inc., P.O. Box 191, Chagrin Falls, Ohio.*



1. Rubber shock mount; 2. fixed contact assembly; 3. fixed contact detail (kick out spring); 4. armature with moving contact detail; 5. beryllium copper bracket; 6. Alnico magnet; 7. bearing detail (cushioned jewel); 8. steel yoke; 9. frame.

For more information circle **629** on inquiry card.

A-c. Relays



New "Series 25" a-c. relays feature ¼-in. coin-silver contacts rated at 10 amps. 110 v.ac.; cantilever spring-action yoke; either Lamacoid or Bakelite insulation; either 2C or 2C-1A contact arrangement.—*Kurman Electric Co., Inc., 35-18 37th St., Long Island City 1, N. Y.*

For more information circle **630** on inquiry card.

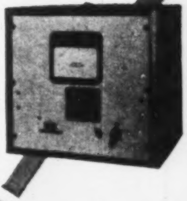
Subminiature Snap Switch

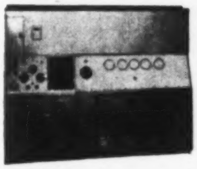
New "Type USM" subminiature snap-acting switch is designed to facilitate making connections; flat ter-

For research or production control

New JAco Double Beam Microspectrophotometer

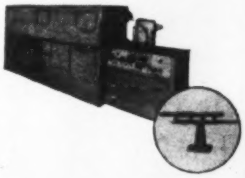
Fast, sensitive instrument for analysis of solutions in both micro and macro quantities. Single meter indicates ratio of optical density to concentration — cuts lapsed time per sample to approximately 2 seconds. Approximately 210 to over 600 millimicron range.





New JAco *Atomcounter* Direct Reading Spectrometer

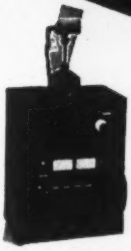
Compact, self-contained instrument that performs complete analyses in under one minute with standard deviations of 1-2%. May be used photographically for qualitative or semi-quantitative analysis, simultaneously with or alternatively to direct reading measurements. Simple unitized construction.



New JAco Ebert Spectrograph with Order Sorter

The widely acclaimed Ebert Spectrograph is now available with an Order Sorter that presents several orders simultaneously at high dispersion, each as an individual spectrum. Rotation of grating produces dispersions ranging from 5 A/mm to 0.18 A/mm with resolving power up to 300,000.

Look to **JAco** for instruments that will make your work easier

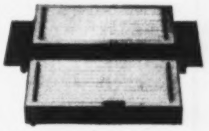


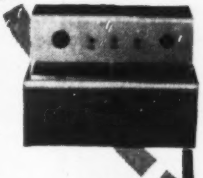
New JA-G1 Wyckoff Hydrogen Discharge Tube

A self-contained ultra-violet source producing high intensity in the range from 1900A to visible. Source is approximately 3 mm in diameter and ⅜" deep with distance from window to source center of 4 cms. Intensity and angle of view far exceed other commercially available types.

JAco Fan Scale Calculator

A new principle in spectrochemical calculating equipment designed by JAco Engineers. Simple slide rule operation eliminates need for plotting emulsion characteristic curve and provides for rapid and continuous check on gamma. Reads directly in terms of concentration.





JAco Photographic Processing Unit

A precision photoprocessing laboratory for films or plates in only 28¾" x 17 3/16" x 18⅛" space. Accurate time and temperature controls assure constant gammas. Entire processing procedure requires only 3½ minutes with minimum attention. Produces plates and film free of frilling, blisters, and curling.

Write today for detailed information on these outstanding JAco Instruments.

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For more information circle **134** on inquiry card.

DALL **Low-Loss** FLOW TUBE

This primary metering device produces important pumping economies by reducing meter head loss to a minimum. Very short laying length — only 1½ to 2 pipe diameters. Lightweight and easy to install. Meters very accurately with regular differential-type instruments. Send for Bulletin 115-L1. Builders-Providence, Inc., 422 Harris Avenue, Providence 1, Rhode Island.

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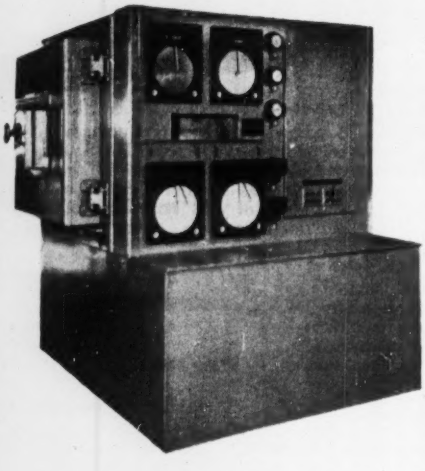
DIVISION OF B-I-F INDUSTRIES, INC.
METERS FEEDERS CONTROLS

See us at the Instrument in Philadelphia Exposition

For more information circle **135** on inquiry card.

TEST CHAMBERS



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Electronic or pneumatic recording or indicating control system

CUSTOM CHAMBERS built to specifications.

Standard
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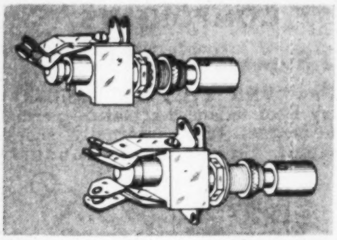
For more information circle **136** on inquiry card.

minal lugs widely separated in switch base; terminals plated for rapid soldering. Switch size: 25/32 by 23/64 by ¼ in. Plain or leaf-actuator styles. Rated for s-p.d-t. operation at 5 amps. 125/250 v.ac. or 2 amps. 30 v.d.c.—*Unimax Switch Div., The W. L. Maxson Corp.*, 460 *W. 34th St., New York* 1, *N. Y.*

For more information circle **631** on inquiry card.

Instrument Switches

New instrument push-button switches molded of moisture-resistant mica-filled phenolic were designed for galvanometer circuits, etc., where extremely low contact resistance is desired; are available in s-p.s-t. and d-p.s-t., momentary-contact and turn-to-lock.—*Shallcross Mfg. Co., Collingdale, Pa.*



For more information circle **632** on inquiry card.

Sealed Limit Switch

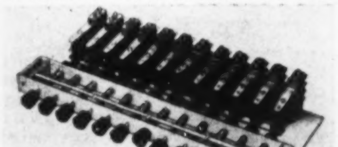
2396

New hermetically sealed limit switch, formerly for aircraft use, now available for industrial applications, operates when completely immersed in water or coated with ice. Among features: Teflon and silicone diaphram seal permitting complete flexibility of actuator; all vital components sealed in inert gas.—*Electro Snap Switch & Mfg. Co.*, 4222 *W. Lake St., Chicago* 24, *Ill.*

For more information circle **633** on inquiry card.

Push Button Switches

New "Model MPB" comprises an extruded frame on which are mounted push button units of two to a maximum of twelve positions. They can be supplied in following types: accumulative lock; no two interlock; lock release; and non-lock.—*General Control Co.*, 1200 *Soldiers Field Road, Boston* 34, *Mass.*


2654

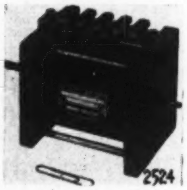
For more information circle **634** on inquiry card.

Miniature D-c. Solenoids

New "Nos. 20288 and 20287" d-c. solenoids are considerably smaller and lighter than standard. Former has a coil enclosed in a steel shell; latter has an open coil with a bracket. They measure ¾ in. dia. and approx. 1½ in. long; may be wound for a wide range of voltages. Example of pull characteristics: 24-v. 13-amp. type on intermittent duty, 5-sec. maximum, 20 C. ambient, pulls 25 oz. at ¾-in. stroke.—*Cannon Electric Co., 418 W. Avenue 33, Los Angeles 31, Calif.*

For more information circle **635** on inquiry card.

Low-inertia Servomotor



New "Type DPJJD-764-38" two-phase two-pole induction servomotor with double-ended shaft has a low-inertia squirrel cage rotor designed to eliminate cogging at low speeds; weighs 23 oz.; features high torque-to-inertia ratio, low starting voltage, and linear torque-speed characteristics with maximum torque at stall. It can be wound with 2 or 4 poles. Characteristics at 60 cps.: 5 watts output, 5 oz.-in. stalled torque, control phase stalled impedance 5000 ohms. Available also for 400 cps.—*The Electric Indicator Company, Inc., Springdale, Conn.*

For more information circle **636** on inquiry card.

Servomotor

New "Type M-130" 400-cps. servomotor, in 1.062.-in. O.D. size, features sealed stator providing high operating stability, and high torque-to-inertia ratio for servomechanism and computing applications. Unit is inoperative under single-phase conditions. Sloping speed-torque characteristic provides viscous damping in control applications. No-load speed 6200 rpm; stalled torque 0.63 oz-in.; rotor inertia 1.1 gr.-cm^2; weight 4.5 oz.—*Infra Electronic Corp., 553 Eagle Rock Ave., Roseland, N. J.*

For more information circle **637** on inquiry card.

Miniature Motor

New "Model 1050 Servo Control Borg-Motor" was specifically designed to operate maker's "Micropots" but can be used in servo applications, etc. Approx. dimensions 1½ in. dia; 1½ in. long; ½ in. shaft extension. Minimum locked rotor torque 0.82 oz.-in. in either direction on 115 v.ac. 400 cps. No-load speed, 5500 rpm.—*Borg Equipment Div., The George W. Borg Corp., Janesville, Wis.*

For more information circle **638** on inquiry card.

High-temperature Servomotors

New high-temperature servomotors, which can operate in regions of 160 C. (320 F.) include BuOrd Mark VII and Mark VIII and 15 others, all with

SOLVED

weighing and testing problems by

EMERY force-measuring systems

Emery load cells offer the fundamental solution to *any* force-measuring or weighing problem.

Operating on simple, basic physical principles, Emery systems are maintenance-free. Some units have been in service over 25 years without even recalibration!

RANGES: 0 - 10,000,000 pounds . . . **ACCURACY:** 1/10 of 1% of range . . . **RESPONSE:** less than ½ second . . . **TYPES:** self-contained hydraulic, open-flow hydraulic, pneumatic . . . **CELL DEFLECTION:** less than 0.005" . . . **APPLICATIONS:** Weighing, Jet Engine Thrust, Brake Testing, Torque Measurements, Strength of Materials, Process Control, Tank Weighing, Platform Scales, Etc.

Since 1872, Emery Force-Measurement Systems have been lowest in initial cost, in operating cost, and require no maintenance.

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☐ **Literature on hydraulic weighing**

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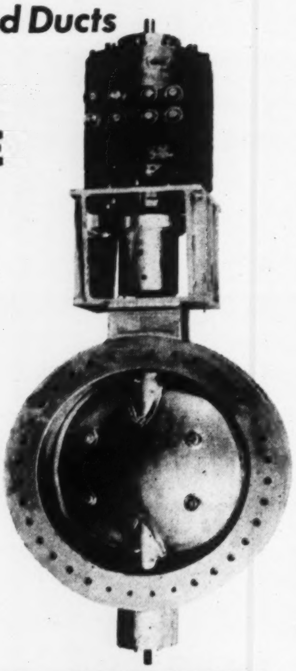
Attach to, or write on, your company letterhead.

For more information circle **137** on inquiry card.

A Boon to Your Pipe Lines and Ducts

- **POSITIVE CONTROL**
- **INSTANT RESPONSE**
- **TIGHT SHUT-OFF**



This W. S. Rockwell 30" cast steel Butterfly Valve, with stainless steel rim on valve disc for corrosion resistance, handles air and hydrocarbon exhaust gases at 50 p.s.i. and 350° F. maximum temperature. It is operated by a heavy duty hydraulic rotary cylinder.

W. S. Rockwell Valves are made in sizes to 132", of any metal or rubber-lined with any automatic or manual operator. They are designed to meet required operating conditions at temperatures to 2000° F. and pressures to 300 p.s.i. and higher.

ROCKWELL SINCE 1888 BUILT

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BUTTERFLY VALVES • SLIDE VALVES • AUTOMATIC VALVES

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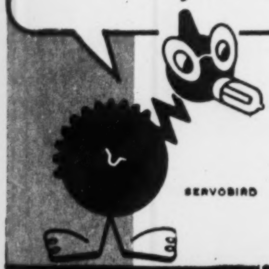
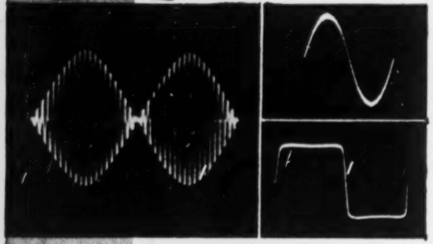
For more information circle **138** on inquiry card.

The New Servoscope® puts another engineer on your staff

... but not on your payroll



Are you engineering any type of feedback control system—regulators, governors, process controls, positioning or speed servos? With a Servoscope an extra engineer will be working for you on design synthesis, analysis or production test. • Breadboard your intended servo system or other circuit designs—then, by either the frequency response or the transient response method, magnitude and phase curves can be obtained directly within minutes. • For detailed information on how this versatile test instrument can save manpower, materials and money, write Dept. I-8.



Output wave forms of Servoscope displayed against internal linear sweep generator, frequency ½ cps.

SERVO CORPORATION OF AMERICA

New Hyde Park, New York

SC122A

For more information circle **139** on inquiry card.

high torque-to-inertia ratios and meeting all military humidity, salt-spray and fungus requirements.—*American Electronic Mfg., Inc., 9503 W. Jefferson Blvd., Culver City, Calif.*

For more information circle **639** on inquiry card.

Servomotor

New "Type M-100" low-inertia servomotor features: new lamination design, hermetically-sealed stator for operating stability; high torque-to-inertia ratio. Unit is designed to be inoperative under single-phase conditions and a sloping speed-torque characteristic provides viscous damping in control applications. Voltage, 115 (fixed phase), 115/57.5 (control phase); 400 cps., 2-phase, 4-pole. No-load speed, 10,000 rpm; stalled torque, 2.7 oz.-in; rotor inertia, 4.0 gr-cm. Weight, 12.2 oz.; OD, 1.750 in.—*Infra Electronic Corp., 553 Eagle Rock Ave., Roseland, N. J.*

For more information circle **640** on inquiry card.

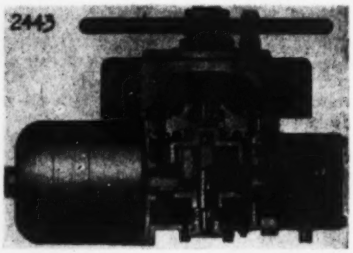
Synchronous Motor

New "Type KX" will deliver 30 oz.-in. of torque at 1 rpm.; incorporates design features of the motor it supersedes: "Type SX" which was "the most powerful synchronous motor on the market for its size." In addition, new improvements: no slip or sub-synchronous speed; start and stop within 2 cycles. Available in speeds from 60 rpm. to 1 rpd. for right, left or oscillating rotation; also standard clutch, reverse clutch and in dual motor designs. U. L. approved.—*R. W. Cramer Co., Centerbrook, Conn.*

For more information circle **641** on inquiry card.

Valve-operating Unit

New "Tork-Master" electric valve operators, for valves in sizes from 2½-in. upward, feature wide range of operating speeds, output torque, and length of travel to accommodate various valve designs and operating conditions. Installed on valves in or out of service without alteration of valve. —*McBain Corp., 6251 W. Century Blvd., Los Angeles 45, Calif.*



For more information circle **642** on inquiry card.

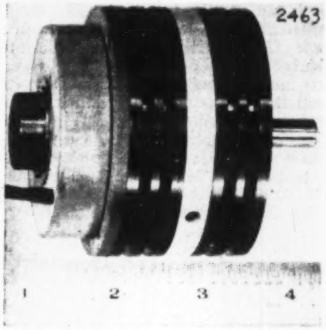
Synchros

New "Size 10 Synchros" are said to feature "accuracies available before only in much larger units." Maximum diam. 0.937 in.; maximum over-all length 1.281 in.; weight 1.8 oz. Units are available with 12-in. leads, with radial terminals or with axial terminals; as signal generators, repeaters, control transformers, high-impedance control transformers, control differentials, resolvers, and sine-cosine generators.—*Clifton Precision Products Co., Inc., Marple at Broadway, Clifton Heights, Penna.*

For more information circle **643** on inquiry card.

Magnetic Fluid Clutch

New "731B" magnetic fluid clutch utilizes a grease-like lubricant in which fine magnetic particles are suspended. Application of d.c to coil causes fluid to "stiffen" in proportion to current. Clutch allows for 40 watts of heat dissipation; develops up to 50 lb.-in. torque; at maximum recommended speed of 800 rpm. it can transmit up to 475 watts.—*Raymond Engineering Lab., Inc., Smith St., Middletown, Conn.*



For more information circle **644** on inquiry card.

MECHANICAL COMPONENTS

High-precision Gear Boxes

New gear boxes for use in servomechanisms, computers, etc., are virtually friction-free and backlash-proof; are available in speed ratios from 20:1 to 3125:1.—*Link Aviation Devices, Inc., Binghamton, N. Y.*

For more information circle **645** on inquiry card.

Air Supply Filter

New air filter, designed to prevent dirt, oil, water and other foreign matter from entering pneumatic instruments, consists of: a top cap with supply and outlet connections; chamber with a drain cock at bottom; resin-impregnated filtering sleeve; and water baffle. Moisture drops to bottom of chamber and is easily drained off or blown out. Inexpensive filter sleeve removes particles as small as 40 microns. Capacity 4 cfm. of air or natural gas (enough to supply ten "Model 40" controllers); sump capacity 12 cu. in.; max. working pressure 150 psi.—*The Foxboro Co., Foxboro, Mass.*

For more information circle **646** on inquiry card.

Teflon Spaghetti Tubing

High-temperature "Polypenco" Teflon spaghetti tubing of high dielectric strength is unaffected by repeated

precision electronic instruments by DeJUR

non-linear function

C-200

external phasing potentiometer

- Logarithmic, sine-cosine and other shape functions
- Multiple, adjustable taps
- Unitized design for universal coupling
- Precision machined aluminum housing
- Servo or single hole mounting

For further information write DeJUR-Amsco Corporation, Dept. IC 28, 45-01 Northern Blvd., Long Island City, 1, N. Y.

*Also available as linear model.

ELECTRONIC DeJUR U.S.A. INSTRUMENTS

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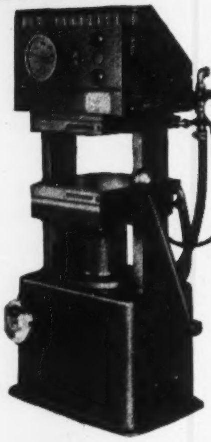
For more information circle **140** on inquiry card.

Formerly The PRECO

A new name
A better press

Now...The P·H·I



Compact • Dependable

- *accurate temperature and pressure controls*
- *ram pressure up to 60 tons*
- *fast-action two stage pump*
- *choice of platens: 8"x 8", 8¾"x 12", 12"x12", 12"x18", 18"x18"*
- *Special hot-cold laminating press*
- *modification to suit customer requirements*

P-H-I Hydraulic Presses are used wherever specifications call for quick-acting pressure up to 60 tons and accurate temperature control to 600°F. May be operated individually by built-in hand pump, or in batteries from a central hydraulic system. *Write for detailed circular.*

PRESS

PASADENA HYDRAULICS, INC.
279 N. Hill Avenue,
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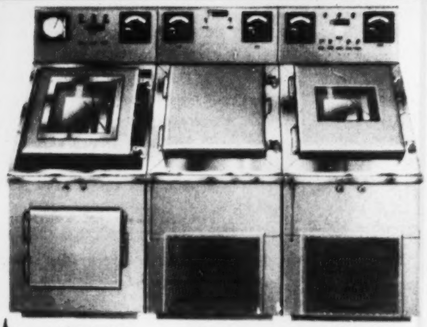
For more information circle **141** on inquiry card.

MURPHY & MILLER
Test Cabinets
BOOTH #237 • INSTRUMENTS SHOW

See The New Design..



Exclusive New Slope Front... Easier Viewing, Faster Loading!

These new design Murphy & Miller environmental test units are compact, portable and inexpensive. Any individual unit or combination of units available to meet your requirements. Temperatures from +200°F to −100°F; Humidities from 20 to 95%.

FEATURES:
- **Stainless steel test space — approx. 2 cu. ft.**
- **Forced air circulation**
- **Automatic temperature and humidity controls**
- **Slope front design permits easier loading, viewing ... maintains more uniform test conditions**
- **Chamber designed to operate on 110 V. connection**

See them at the Instruments Show or write for complete details and specifications.

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For more information circle **142** on inquiry card.

flexing or by heat from soldering irons; is available in a wide range of sizes, in seven colors, for color-coding, in a full ID range corresponding to AWG 24 through 8.—*The Polymer Corp. of Penna., Reading, Pa.*

For more information circle **647** on inquiry card.

VALVES

Bellows Valves

New "440 Series" small stainless-steel bellows valves, specifically designed for highly corrosive applications, high-vacuum work and mass spectrometry, provide a low leakage rate across seat and into valve (less than 0.001 micron cfh). Back-seating feature is especially useful in corrosive fluid application in event of a bellows rupture. Pipe sizes are ⅛-in. to ½-in. with ¼-in. and ½-in. Swagelok tube ends.—*Hoke, Inc., 231 S. Dean St., Englewood, N. J.*

For more information circle **648** on inquiry card.

Solenoid Valve

New solenoid valve of stainless steel for high pressures is offered in ½-in., ¾-in. and 1½-in. pipe sizes. ½" and ¾" are rated to 2500 psi. and 1½-in. to 3000 psi. Piston rings compensate for expansion under heat and eliminate sticking. Valves available for normally open and normally closed operation with bubble-tight pilot valve feature. Explosion proof housings optional.—*Dep't S469, Atkomatic Valve Co., 545 Abbott St., Indianapolis 25, Ind.*

For more information circle **649** on inquiry card.

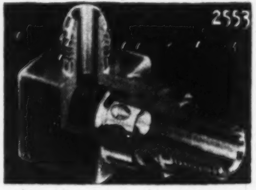
Teflon-plug Valves

New "Lo-Temp" valves use Teflon tapered plug, thereby obviating need for a lubricant, and seizing at low temperatures, which have limited applications of metal tapered plug. Lubricant is no longer needed to prevent seizing at temperatures as low as −65 F. and as high as 250 F., and pressures to 100 psi. "Lo-Temp" Valves are made in angle, 2, 3, and 4-way types, with or without drain, aluminum alloy or stainless steel body, flanged for panel mounting. Sizes ⅛-in. to 1-in. for pipe, and 4 to 12 for tube connections; wide choice of plug drillings.—*Republic Mfg. Co., 1930 W. 77th St., Cleveland 2, Ohio.*

For more information circle **650** on inquiry card.

Right-angle Check Valve

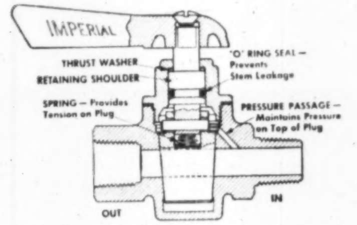
New "P-602" right angle check valve has all of characteristics of maker's standard inline "200 Series" but fits into a system in a limited space; is of same chatter-free zero-leakage design as in other "Circle Seal" Valves.—*James-Pond-Clark, 2181 East Foothill Blvd., Pasadena 8, Calif.*



For more information circle **651** on inquiry card.

Plug Valves

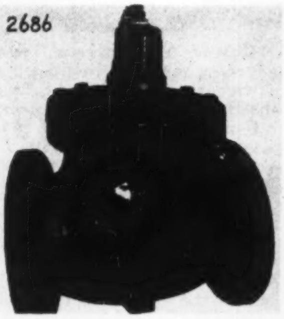
New "200 Series" improved plug type valves for instrumentation, pneumatic applications, fluid transmission systems, etc., feature a pressure balanced plug; working pressures to 300 psi.; brackets for mounting on instrument panels, etc.; constant line pressure on top of plug eliminates possibility of plug lifting. Three pipe sizes: ⅛-in., ¼-in. and ⅜-in. Valve is directional and inlet is marked.—*The Imperial Brass Mfg. Co.*, 1200 *W. Harrison St., Chicago* 7, *Ill.*


IMPERIAL
THRUST WASHER
RETAINING SHOULDER
SPRING — Provides Tension on Plug
'O' RING SEAL — Prevents Stem Leakage
PRESSURE PASSAGE — Maintains Pressure on Top of Plug
OUT
IN

For more information circle **652** on inquiry card.

Shut-off Valves

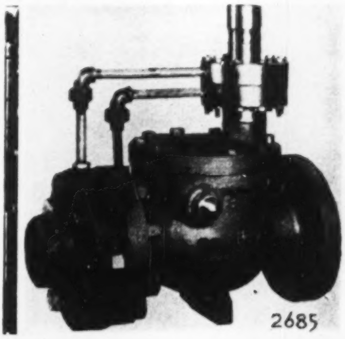
New "Sentry Instant-Closing" solenoid-controlled valves may be used to close any desired fuel or process lines, continued flow through which would be undesirable under emergency conditions. Damage to closed electrical systems will close valve and sound alarms. Use of available supervisory system accomplishes the same action in open-circuit. Sizes to 8 in.—*McRae Valve Corp.*, 621 *S. Spring St., Los Angeles* 14, *Calif.*



For more information circle **653** on inquiry card.

Excess Flow Valves

New "Sentry" valves close instantaneously when flow rates exceed predetermined maxima; normally are held open by a latch which, in turn,



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Exclusive Design provides control within tolerances previously unattainable

Model JS employs no relay. It modulates the input according to the demand, feeding more or less power as required but passing full power only during the initial heating period. It is thus truly a *Stepless Controller.*

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Kellogg Crossbar Switch provides the fast, low-cost means of interconnecting or selecting many different circuits common to large-scale switching required by automatic control systems or computers. Its many applications include, for example, connecting any 3 of 60 circuits to any of 75—or choosing 1 circuit from as many as 936. It provides circuit connections in 50 milliseconds by energizing two specific coils. For optimum fidelity of signal and prevention of corrosion, palladium contact points are used. Mounted for drawerlike removal from its rack. Get the complete facts — Write Dept. 61-H today.

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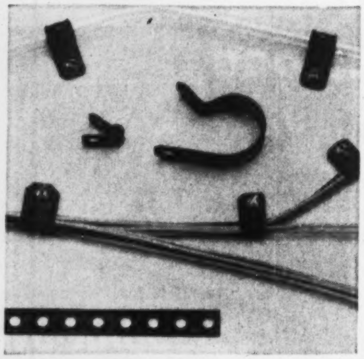

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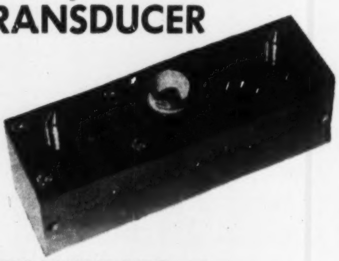

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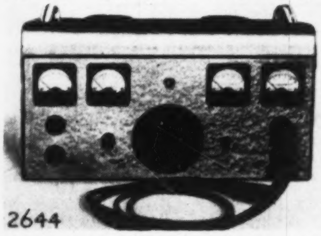
is positioned by a diaphragm balanced normally by preadjusted springs. Standard 250 psi. class unless otherwise specified. Valves may be used to shut off one line when excessive rates of flow are encountered in another. Likewise, over-riding controls may be installed by means of solenoid valves or extended control tubing to introduce a time delay.—*McRae Corp., 621 S. Spring St., Los Angeles 14, Calif.*

For more information circle **654** on inquiry card.

EDUCATIONAL, etc.

Portable Science Panel

New portable science panel, said to be ideal for teaching, is 16¾ in. long, 10¼ in. high, 10½ in. deep; plugs into 115 v.ac. A "Powerstat" variable transformer gives 0-24 volts up to 10 amps. Separate a-c. and d-c. indicating instruments.—*The Electronic Rectifier Company, Rochester, N. Y.*



2644

For more information circle **655** on inquiry card.

Graphic-circuit Kits

New "Printed Circuit Kits" are said to provide all components required in laboratory formation and evaluation of a "printed" circuit. Process requires an initial inking of copper laminate, followed by an etching bath with a final neutralizing bath. Circuits are etched—not printed. Kits include all materials, laminate plus instructions on lab formation of printed wiring, printed coils and printed capacitors.—*Electronic Products Co., 1315 Jericho Turnpike, New Hyde Park, L. I., N. Y.*

For more information circle **656** on inquiry card.

Network Board

New "Model P100 Network Board incorporates three resistance and three capacitance decade units, each covering 0 to 1,111,000 ohms in 100-ohm

steps, and 0 to 1.111 mfd in 0.0001-mfd steps, respectively. Unique switching panel graphically presents possible series and parallel decade combinations; permits immediate connection of a large number of standard *R-C* circuits. Among features: (1) precision components; (2) Unused decades automatically isolated and available for normal substitution use.—*Instrument Research Co.*, 371 *Harvard St., Cambridge* 38, *Mass.*

For more information circle **657** on inquiry card.

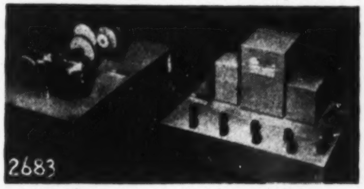
Breadboard Chassis

New "Universal Circuit Breadboard Chassis" accommodates a complete variety of components without need for a power tool; comprises a cadmium-plate 4x12x3 in. chassis frame and an assortment of phenolic subchassis which can be mounted quickly. End brackets of frame have a series of ½-in. holes for regular and miniature VDR's, fuses, and switches. Frames can be tiered, mounted side-by-side, or end-to-end. Phenolic subchassis of four basic designs plus a terminal strip are provided. Basic subchassis accommodate a variety of tube sockets, capacitor cans, etc., which can be mounted in several ways.—*Replacement Sales Dep't, Cathode-ray Tube Div., Allen B. Du Mont Labs., Inc.*, 750 *Bloomfield Ave., Clifton, N. J.*

For more information circle **658** on inquiry card.

Servo Demonstrator Unit

New "Model MA-93001," for teaching and research, consists of (1) gear train unit including motors, synchros, and tachometer and (2) amplifier assembly containing magnetic amplifier, demodulator, stabilizer, and terminals making different parts of circuit readily accessible.—*Magnetic Amplifiers, Inc.*, 632 *Tinton Ave., New York* 55, *N. Y.*



For more information circle **659** on inquiry card.

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VOR Course Indicator

New "ARC-16706 Course Indicator," for use with "Type 15D" VOR

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Eastern company wants engineer experienced in design and application of pneumatic instruments. Familiarity with automatic control theory important. If you are between 25 and 40 years old, and have proper educational and industrial background, this is a real opportunity for you. Tell us about yourself and your experience. Give approximate salary needs. Box 268 Instruments Publishing Company, 845 Ridge Avenue, Pittsburgh 12, Pennsylvania.

For more information circle **150** on inquiry card.

Valve Design Engineer WANTED

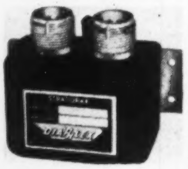
Experienced in design of medium and large sized valves primarily for water service. Prefer engineer 30 to 40 years of age. Must be capable of directing design — also willing to travel for on-location assistance of sales personnel. This position is with a fast-growing New England company. Send complete resume and salary requirements to Box 269 Instruments Publishing Company, 845 Ridge Avenue, Pittsburgh 12, Pennsylvania.

For more information circle **151** on inquiry card.

airborne receiving equipment, combines all functions of a cross-pointer meter and course selector; saves instrument panel space; weighs 3.3 lbs. —*Aircraft Radio Corp., Boonton, N. J.*

For more information circle **660** on inquiry card.

Ice-detection System



New "Ice Detection System" meets Air Force test requirements, provides fully automatic de-icing control. Detector housing includes a case heater and a thermostat to maintain an elevated temperature in case and prevent condensation in housing. Interpreter Assembly (illustrated) comprises arming circuit, power relay and automatic protective circuits. Before each flight, automatic arming circuit provides a complete functional check of probe, pressure switch and electric circuit.—*Cook Electric Co., 2700 Southport Ave., Chicago 14, Ill.*

For more information circle **661** on inquiry card.

MISCELLANEOUS

Control Systems

New control systems, claimed to embody "new and unique principles of operation," include (1) "Autoflite" autopilot for automatic control and stabilization of flight; (2) "Navitec" navigation control, guidance, and computer system; (3) "Protinav," utilizing pitch-roll tracking and yaw proportional navigation; (4) industrial automatic control systems and computers designed to customer specifications.—*Mark Instrument Co., Inc., 613 Wilshire Blvd., Santa Monica, Calif.*

For more information circle **662** on inquiry card.

Concealed UHF Tuner

New "Hideaway" conversion tuner mounts at rear of TV set; slide-rule tuning dial protrudes slightly above top; tuning knob and selector switch accessible at right rear. Three models for different requirements.—*Granco Products Inc., 36-17 20th Ave., Long Island City 5, N. Y.*

For more information circle **663** on inquiry card.

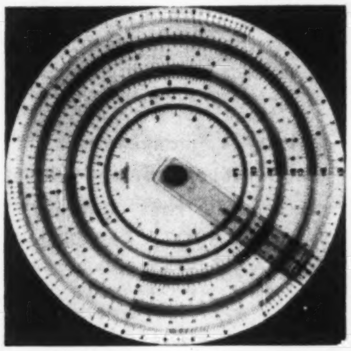
Voltage or Current Regulator

New "Rota-Mag," adaptable to all d-c. and 60-cycle a-c. generators as well as high-cycle alternators, is available as a voltage control or current control. Regulation is accomplished with a magnetic amplifier. Less than 0.4-v. deviation in generator output voltage results in a full swing of magnetic amplifier output. Response as fast as 0.2 sec. no-load to full-load.—*Electronics Div., Hufford Machine Works Inc., 2201 Carmelina Ave., Los Angeles 64, Calif.*

For more information circle **664** on inquiry card.

Circular Slide Rule

New 8 in. diameter circular slide rule of Vinylite laminated plastic, is equivalent to a straight type over 20

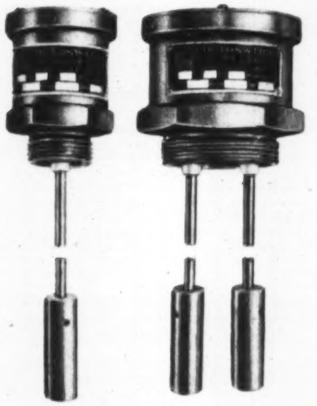


in. long; has fine graduations in blue and black, protected by clear overlamination.—*Allegheny Plastics, Inc., 47 Thorn Run Rd., Coraopolis, Pa.*

For more information circle **665** on inquiry card.

Level-control Probes

New "Series 67" probe fittings are said to "offer to industry a new standard of flexibility, long life and



maintenance-free operation."—*Photoswitch Inc., 77 Broadway, Cambridge 42, Mass.*

For more information circle **666** on inquiry card.

Industrial-TV Kinescope

New "Auricon Super 1200" camera has new "TeleVision Transcription TV-T Shutter" which now permits photographing TV pictures from a receiver tube, occurring at 30 frames per second, onto 16-mm. motion picture film at 24 frames per second with-

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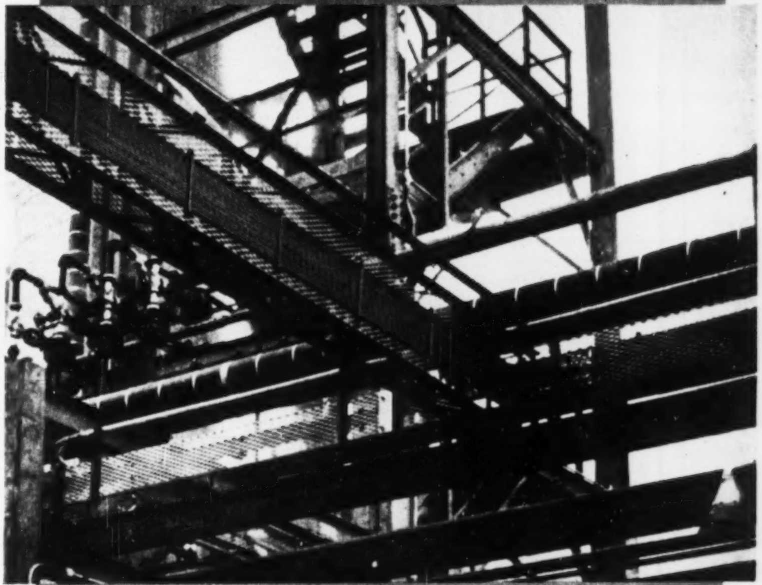
instrument Tubing Trough has become a LONG SPAN SUPPORT



see it at the International Instruments Exposition

Completely fabricated flattened expanded metal Instrof now not only offers a full system for supporting instrument tubing but a system (as shown in this photograph) for spans up to 32 feet.

This is just one of the recent Instrof developments which will be on display at Booths 932 and 934 at the First International Instruments Exposition in Philadelphia.

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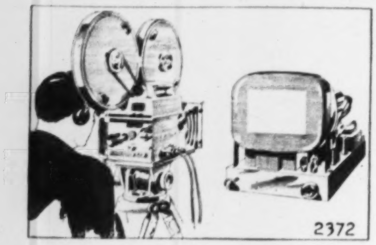
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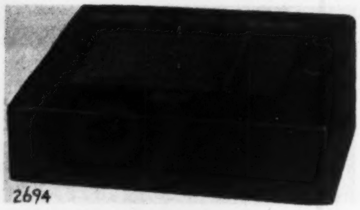
out loss of picture quality.—*Berndt-Bach, Inc., 7377 Beverly Blvd., Los Angeles 36, Calif.*

For more information circle **667** on inquiry card.

COMPUTING

X-Y Recorder

New "Model 2" of maker's "Autograf" is for use with 11x16½-in. graph papers; has a flat-bed table so that curves are available for observation and labeling while they are being drawn. It may be equipped with curve-follower attachment or modified for digital point plotting. Optional equipment: keyboards, card and tape readers. Maximum sensitivity 0.5 mv./in. on both axes; other specifications same as "Model 1."—*F. L. Moseley Co., 409 N. Fair Oaks Ave., Pasadena 3, Calif.*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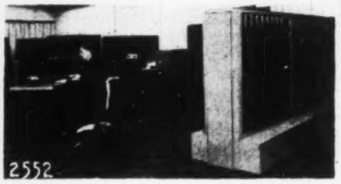
For more information circle **668** on inquiry card.

Electronic Computer

New "Type 702" electronic data processing machine, designed for business use, is said to be "the fastest and most flexible commercial data processing system ever devised." Principal units: a central arithmetical and logical unit capable of performing more than ten million operations in an hour; a bank of cathode-ray memory tubes; reels of magnetic tape which feed data to machine and write down answers at rate of 15,000 letters or numbers a second. Punched card readers and punches, and line printers also are provided.—*International Business Machines Corp., 590 Madison Ave., New York 22, N. Y.*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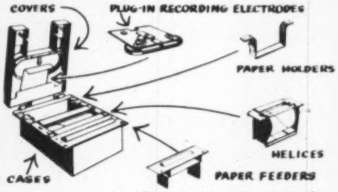

Patents granted and pending

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Here is the way to capture information of a very involved nature occurring at high speeds. With these Alden components you can put together a recorder **easily**, that will answer today's requirements of simultaneously recording many phenomena of involved character. The flying spot marks the Alfax paper only when signal is present.

By selecting the proper flying spot speeds, paper feeds and paper width, you can build up a recorder to record any phenomenon you are interested in, together with any number of related phenomena occurring simultaneously. The resulting recorder will be a type that can operate without attention or need of adjustment because the components incorporate Alden techniques which use the tiny metal deposits from the recording electrodes in a self-compensating system. It is possible to operate for any length time in any environment unattended except for paper replacement.

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To get started building recorders into your product, let us know what you'd like to record and send for "Flying Spot Literature."

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Westboro, Mass.

Events...

Sept. 13-25

Instrument Society of America First International Instrument Congress and Exposition, Commercial Museum and Convention Hall, Phila. Contact Richard Rimbach, Mgr., 845 Ridge Ave., Pittsburgh 12, Pa.

September 17-18

Ninth Annual Calorimetry Conference at General Electric Research Laboratory. For information write James Stokley, General Electric Co., Schnectady 5, N. Y.

September 21-23

Annual Meeting and Exhibition, Society for Experimental Stress Analysis, Bellevue-Stratford Hotel, Philadelphia. For information write Mr. Frank G. Tatnall, P.O. Box 4034, Philadelphia 18.

September 29-30

Pittsburgh Conference on Industrial Electronics, sponsored by Professional Group on Industrial Electronics, Institute of Radio Engineers, at the Mellon Institute of Industrial Research, 4400 Fifth Ave., Pgh. 13, Pa. For information contact Dr. James Woodford, Carnegie Tech P. O., Pittsburgh 13, Pa.

October 1-5, 1954

Congrés International de Chronométric, Paris. For information write R. Baillaud, Directeur de l'Observatoire National de Besancon, Besancon, France.

October 4-6

10th Annual National Electronics Conference, Hotel Sherman, Chicago, Ill. For information write R. E. Hornacek, c/o Illinois Bell Telephone Co., 208 W. Washington St., Chicago 6, Ill.

October 6-7

First Annual National Conference of the Institute of Radio Engineers Professional Group on Nuclear Science, Sherman Hotel, Chicago, Ill. For information write S. J. Goslovich, 517 Forest Ave., Glen Ellyn, Ill.

October 12-15

Eighth National Chemical Exposition, Chicago Coliseum, Ill. For information write Chicago Sec. of American Chemical Society, 86 E. Randolph St., Chicago 1, Ill.

October 13-17

Annual Convention and Fair, Audio Engineering Society, Hotel New Yorker, New York City. For information write C. J. LeBel, Secretary, A.E.S., P. O. Box 12, New York 11.

October 14-15

10th Annual National Conference on Industrial Hydraulics, Hotel Sheraton, Chicago. For information write Conference Secretary, Illinois Institute of Technology, Chicago 16, Ill.

October 25-27

Machine Tool Conference, American Institute of Electrical Engineers, Hotel Statler, Detroit. For information write R. S. Gardner, A.I.E.E., 29 W. 39th St., New York City.

November 21-22

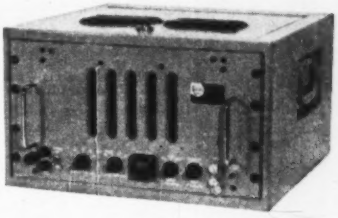
Automatic Control Equipment Exhibition, Waldorf-Astoria Hotel, New York City.

November 29—December 2

First International Automation Exposition and Computer Clinic, at the 244th Coast Artillery Armory, New York City, N. Y. For information write First International Automation Exposition, 845 Ridge Ave., Pittsburgh 12, Pa.

for reliability

★ ELECTRONIC COUNTER MODEL 111



- General purpose events counter.
- Pulse input—0-100 kc;
- Sine Wave Input—10 cps—100 kc
- Ambient Temp. Range −20° to +150° F.
- Input metering and self checking.
- Count Accuracy of ±1 unit in 100,000.
- Plug-in, sub-assembly construction.
- 99,999 Counter Capacity

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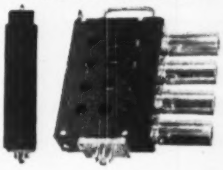
★ PLUG-IN DECIMAL COUNTER ZA-10057



- Rise Time of 0.05 microsec. min. and 2.0 microsec. max.
- Pulse Duration of 1 microsec. min. and 10 microsec. max.
- Input of 32 volts min. and 50 volts max.
- Etched circuit construction.
- Range of 0-100,000 pulses per sec.

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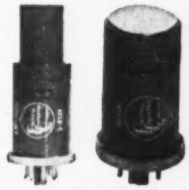

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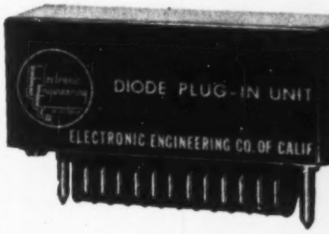

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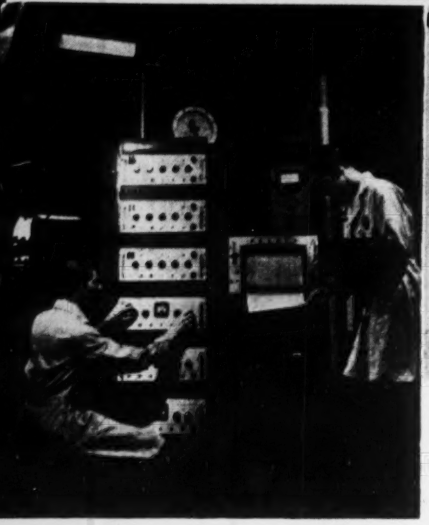

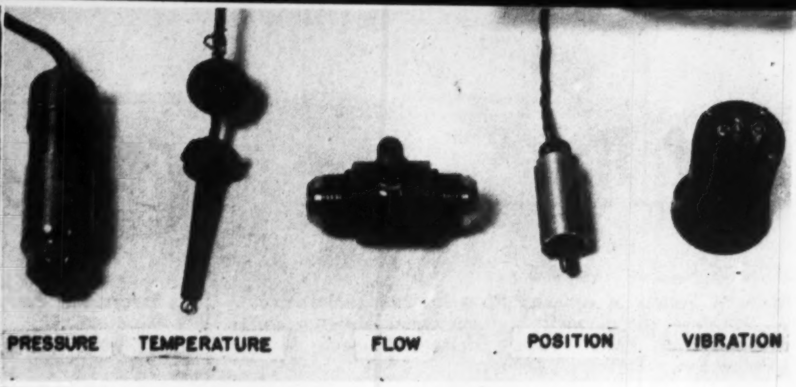

Fig. 1. (Left), Portable test facility comprising Brush 6-channel direct-writing oscillograph and associated amplifiers; (right), types of transducers used.

by R. D. BURDETT and B. F. BURDICK
General Electric Company

JET-ENGINE TESTING

Instruments and techniques for transient testing of jet engines at the Engineering Laboratory, Jet Engine Department, General Electric Company, show the fields of application of various types of pickups, amplifiers, and recorders in analyzing the dynamic behavior of the engines.

JET-ENGINE development and production requires tests that simulate flight maneuvers. This article describes the equipment selected and the techniques used in solving non-steady-state problems in jet-engine testing at General Electric Company.

Equipment Requirements

A primary specification for instrumentation involving transient signals is speed of response; this should be five to ten times faster than that expected from any of the control components on the jet engine. As the equipment had to handle the output of a number of transducers simultaneously (pressure, temperature, position, flow, vibration, speed, etc.) use of a direct-wiring multichannel recorder was indicated. As the equipment was to be used at different test facilities, portability was desirable. These specifications led to the purchase of some 6-channel direct-writing magnetic oscillographs made by Brush Electronics Company (Fig. 1).

Description of Equipment

The oscillographic equipment comprises three major components—(1) the transducer which converts the parameter being measured into an electrical signal, (2) the amplifier which amplifies the transducer signal, and (3) the recorder. Recorders and amplifiers generally are designed to work together and are supplied by one vendor; transducers are supplied from a variety of vendors.

Amplifiers

Six-channel recorders and two types of amplifiers were purchased. One type of amplifier is a high-gain d-c. amplifier suitable for amplifying the output of thermocouples or other small voltages. The second type is a bridge amplifier with a 2000-cycle carrier, suitable for amplifying the output from strain gages and other bridge networks excited by the 2000-cycle supply.

Transducers

For pressure measurement, the transducer selected consists of a diaphragm connected to a bonded-strain-gage bridge (Fig. 1). Diaphragm motion unbalances the bridge.

For flow measurement of fuel and oil, the rotating-impeller-type transducer was selected (Fig. 1). This transducer consists of a small turbine wheel mounted on bearings directly in the flow stream. Flow causes the turbine to rotate; a magnet mounted in the rotor generates an a-c. voltage in a coil mounted on the case of the transducer. The frequency of the output is a function of the flow. An auxiliary circuit converts the a-c. signal into a d-c. signal proportional to the frequency of the input. This piece of equipment is the limiting factor when relatively fast transients are encountered; it will respond to a step-change input in approximately 0.15 second.

Temperature is measured by conventional chromel-alumel or copper-constantan thermocouples (Fig. 1) located in the engine gas stream. For fast transients, care must be exercised in selecting the thermocouple wire size for minimum thermal lag.

For measuring the position of valves, pistons, and other mechanical motions in the control system, two types of transducers have been purchased. One is a simple slide-wire resistor whose slider moves in a linear direction; this pickup is reliable and easy to use where severe vibration is not a problem. The second linear-motion transducer being used is the linear differential transformer (Fig. 1).

Some engine problems require analysis of the vibration of the entire engine and also of the relatively low-frequency vibration of the test dolly. For these tests the velocity-type vibration pickup (Fig. 1) is located on the engine in the area that exhibits the most vibration.

Other Recorder Types Used

For certain non-steady-state phenomena that required either greater accuracy, higher frequency response, or

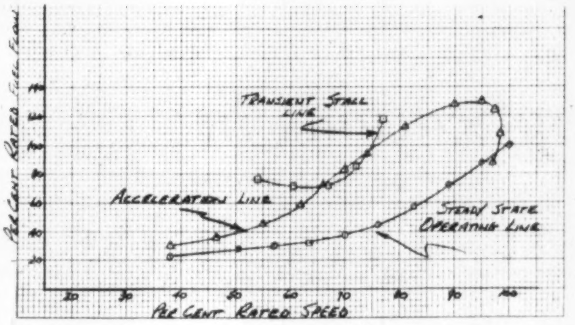

Fig. 2. Typical plot of engine characteristics of a standard engine configuration without bleeds, showing steady-state operating line, acceleration line, and transient stall line.

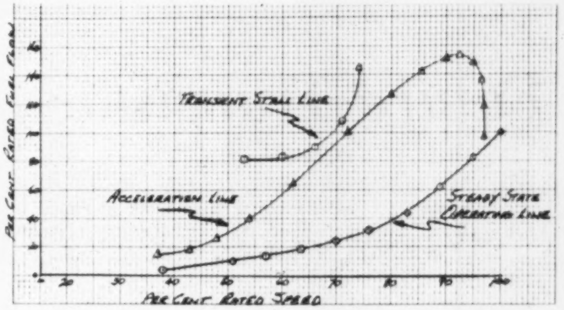

Fig. 3. Engine characteristics with compressor bleeds, showing change in steady-state operating line, acceleration line, and transient stall line. (Compare with Fig. 2.)

simplified data analysis, different kinds of recording systems were used. One recorder of particular value when high accuracy is required and frequency response can be sacrificed is the self-balancing potentiometer; a useful form of this instrument produces an X-Y plot of one parameter vs. another. This recorder has been used to plot engine speed vs. engine vibration due to rotor unbalance, simplifying the determination of rotor critical speeds.

Another recording system was selected to cover the frequency range from 0 to 2000 cycles. This system consists of amplifiers and a recorder (as does the Brush system) but the recorder is a galvanometer-type oscillograph using a beam of light focused on moving film.

Another instrument used in examination of transient data is the magnetic-tape recorder. It is available in the AM or FM form which allows coverage of the frequency range from d.c. to 30 kc. An attractive feature is the "memory" of the tape. Data obtained from a test can be analyzed in the laboratory by playing back the tape into a variety of analysis equipment without losing the quality of the original data. This is useful when it is required that complex waveforms be analyzed, as in tests performed to determine the vibratory stress in compressor blades.

It can be seen, therefore, that each type of recorder has its own field to which it is best suited. Experience has shown that most engine transient testing can be handled adequately by the Brush recording system.

Typical Applications

In an axial-flow turbojet engine it was desired to investigate the changes in the stall characteristics by determining the effect of bleeding air from the compressor during a fast acceleration of the engine. Brush equipment was set up to measure engine speed, main engine fuel flow, exhaust-gas temperature, compressor-discharge static pressure, compressor-discharge total pressure, main fuel-valve position, fuel pressure just before the fuel nozzle, and engine thrust. The equipment was set up and given a basic calibration in the laboratory; it was then installed at the test cell and connections made to the engine.

The stall and acceleration characteristics of a standard engine configuration were examined first, in the following manner: Engine stall was obtained by modifying the control so that controlled step-functions of fuel flow could be injected into the engine. As the magnitude of this step function was increased the engine came closer and closer to a stalled condition. By examining the chart record of compressor discharge pressure at each of these fuel injections it was possible to determine the minimum fuel flow at which stall occurred. Analysis of these records then enabled the engineer to plot fuel flow versus engine speed, to determine the transient stall line, and to compare this line with the steady-state operating line. The distance between these two curves is the margin through which the engine can accelerate without encountering stall. To determine the proximity of the acceleration line to the stall line the engine was accelerated with the control set at standard values and a chart record was obtained for this acceleration. Analysis of the data gave a plot of the acceleration line, which fell between the steady-state operating line and the transient stall curve of the graph (Fig. 2). This procedure for determining both stall and acceleration characteristics was performed for a variety of compressor bleed configurations (Fig. 3).

As high accuracy and repeatability were required of the equipment on this test, instability of the equipment from one run to the next was checked by stabilizing the engine before and after each step function of fuel, and by comparing the reading of the chart record with the reading of the steady-state instruments on the engine control panel. This technique assured that any drift in the equipment that occurred during the stall was accounted for. Before and after each configuration a similar calibration was made at steady-state engine-speed points. This supplied information on the stability of the calibration of the recording system over the period of time required to complete the test of one configuration. It is estimated that with these precautions the over-all accuracy of the data from the Brush system was approximately two percent.

Improvements Needed

Although the recording systems and transducers mentioned enable us to obtain a fair understanding of the dynamic behavior of the engine, each instrument has its limitations. The following list of specific improvements would accomplish the most benefit in the near future:

1. Improve the stability and drift characteristics of the d-c. amplifiers.

2. Increase the gain of d-c. amplifiers and build in calibrated zero-suppression circuits that will enable any millivolt in the range from 1 to 50 to be spread out to cover the full scale.

3. Increase the speed of response for both axes of X-Y recorders to 0.1 second.

4. Design a pressure transducer that can be placed directly in a small pressure line in such a way as to eliminate any tubing between the pressure source and the transducer, so that the flow through the line is unrestricted and no major alteration of the line is required for mounting.

5. Redesign the electronic converter so that its speed of response is 0.01 second for both increasing and decreasing input signals and still maintain pure d-c. output above 20 cycles input.

Future Transistor Applications in

MACHINE-TOOL CONTROL

The characteristically low voltage-drop across transistors suggests uses as "switching" devices in power amplifiers and field controllers. The high sensitivity of phototransistors can open new fields in machine-tool control.

by R. L. BRIGHT
Westinghouse Electric Corporation

SIX YEARS have elapsed since the Bell Telephone Laboratory announced the invention of the transistor. At that time, and in many announcements since, the transistor has been acclaimed as an all-powerful device which would soon replace the vast majority of vacuum tubes in all equipment. During these six years millions of dollars have been spent on semiconductor research and development. As of now, approximately twenty-eight different companies are licensed by Bell Laboratories to manufacture transistors. Despite this enormous effort, there is almost no commercial equipment containing transistors, with the exceptions of hearing aids and computers. The large-scale replacement of vacuum tubes simply has not materialized, and it is unlikely that it will occur for many more years. The reason? It is simply that a transistor is not a vacuum tube. It has some characteristics that are similar to those of a vacuum tube, but it also differs in many important respects. The grid of a vacuum tube draws practically no power from the signal source; a transistor, on the other hand, requires a small but often appreciable power. In most applications, the vacuum-tube characteristics may be considered invariant with temperature; some of the transistor's properties vary greatly with temperature. It is therefore not surprising that transistors have had difficulty in replacing tubes in the circuits and applications that have evolved over the past thirty years. These circuits were tailored to take advantage of the vacuum tube's unique properties, some of which transistors do not even possess.

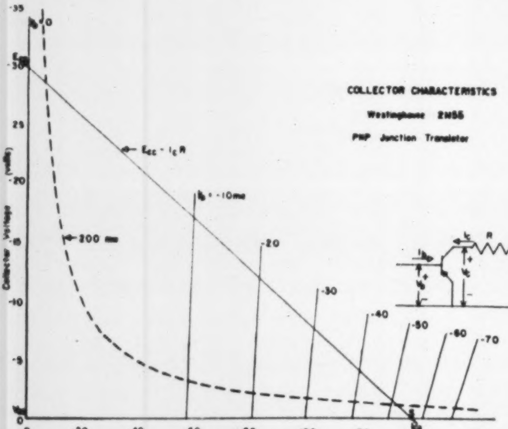

Fig. 1. Characteristic curve of a 200-milliwatt transistor, showing relation between voltage across the unit and load current at fixed input currents.

Unique Properties of Transistors

In attempting to apply transistors, it seems more reasonable to look carefully at the characteristics of the transistor to determine if it has any unique properties which will enable it to perform functions that are not practical with vacuum tubes. It has several such unique properties. The one of principal interest here is the ability of the transistor to control power flow with an over-all efficiency of 98 or 99 percent. The transistor has this property by virtue of a more basic property—namely, its very small voltage drop across the unit under the proper conditions. This drop is less than one volt for large current densities. The efficiencies it permits can be matched only by high-voltage ignitrons. These efficiencies, coupled with the transistor's great reliability, portend a very extensive potential application of transistors in the power control field in the next two or three years.

This time estimate is not over-optimistic. Two years ago, the largest germanium rectifier, which is a relative of the transistor, had a current rating measured in milliamperes. Today, development units have a rating as high as 200 amperes average at 65 volts peak inverse, or 8 kilowatts apiece. There is good reason to expect that transistors capable of controlling kilowatts will likewise be available in another one or two years. Several companies now have comparatively large sized units in their laboratories. No single company has alone succeeded in this achievement.

The unique characteristics and the proper operating conditions referred to earlier are illustrated in Fig. 1. This is a graph of the collector characteristics of a Westinghouse 2N55, PNP, fused-junction transistor. This is a commercially available unit having characteristics similar to those of several other manufacturers.

In its commercial form, it is a small orange plastic cylinder about $\frac{3}{8}$ inch in diameter and about 3/16 inch high and is, thus, about the size of the tip of a little finger. Its rated power dissipation at room temperature is 200 milliwatts—hardly a high-power unit. Nevertheless, it will illustrate the principles involved.

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* Presented at the 18th Annual Machine Tool Electrification Forum, sponsored by the Westinghouse Electric Corporation, Buffalo, New York, April 6 & 7, 1954.

Characteristic Curves

Fig. 1 shows the relationship between the voltage across the unit and the load current through it for fixed values of input current. If, for example, this transistor should be connected in series with a d-c. supply and a resistance load, the operating point of the transistor will be along the line shown. If the input were such that the operating point was near the center of this line, the power dissipation, which is the product of voltage across the unit and the current through it, is far above the maximum rated 200 milliwatts. However, if the operating point is moved upwards, the load current is so small that even though practically the entire supply voltage appears across the transistor, the power dissipation in the unit is still less than the rated value. Similarly, if the base drive is made sufficiently large, the operating point will move down to point "S." Here, we have a large current through the unit but only a small voltage across it; here again the power dissipation is less than the rated 200 milliwatts. However, the power in the load under this condition is approximately equal to the load current times the supply voltage, or about 4.2 watts. This transistor can actually control a load power equal to about 50 times the rated dissipation if its operating points are restricted to lie at the ends of the load line and if the switching time is very fast. The transistor operated in this manner is analogous to a relay which closes a switch in series with the load when the input to its coil is energized (Fig. 2). This characteristic is, of course, of prime importance to the machine-tool industry. The remainder of this discussion will be devoted to the possible applications of such "switching" transistors.

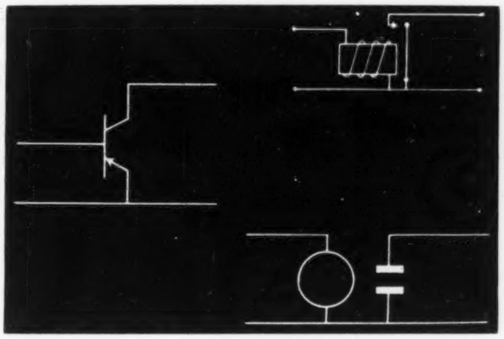

Fig. 2. Transistor used as a relay.

Applications

One of the major obstacles in the application of transistors has been the difficulty of obtaining a stable operating point because the entire family of voltage-vs.-current characteristics shown in Fig. 1 moves considerably with temperature and may differ significantly from unit to unit. As we are concerned only with operation at the two extremes of the load line, these effects are of only secondary importance. Thus, it should be emphasized that transistors when used as switches are not subject to the severe temperature restriction which is generally accorded them and which apply to linear amplifiers. On the contrary, in many applications, such transistor circuits will meet most military specifications. Furthermore, the transistors do not need to be carefully selected. In switching service, all transistors of a given type will be completely interchangeable.

An obvious application of this device would be to replace a relay and take advantage of the fact that a transistor can operate at very high speeds and has no contacts to pit or get dirty. The transistor has the limitation that it is only a three-terminal device and, hence, it must have one lead common to both input and output. Furthermore, it effectively carries only the one contact. Nevertheless, many power-control circuits probably can be redesigned to incorporate such units.

Power Amplifier

Two such switching transistors can be used to make a variable-frequency power amplifier (Fig. 3). If a square wave is applied to the input of this circuit, the two transistors are alternately turned on and off, thereby connecting the supply battery to alternate ends of the winding and, thus, producing a square wave at the output of the same frequency but of a much higher power than the input. One possible application of this device might be as a component in a tape-controlled machine tool. For example, speed information could be recorded on the tape as a square wave of variable frequency; the pickup head might feed into an all-transistor amplifier having two or three stages of the type shown. The output of this amplifier could drive a synchronous motor at the required speed. This system would provide a precise speed control without the complexity of a feedback loop.

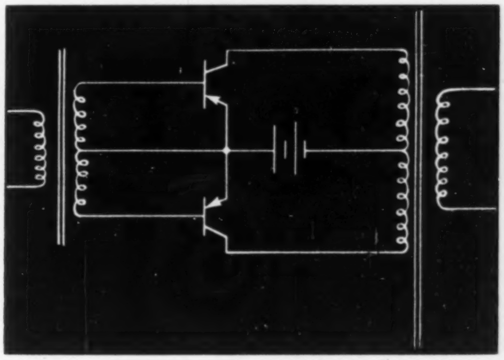

Fig. 3. Two switching transistors used to make a variable-frequency power amplifier.

Thus far, we have indicated how a transistor might be used to pass or block current from a d-c. supply. With minor circuit variations, transistors can also be used to pass alternating currents and block alternating voltages. Thus, they could replace contactors in induction-motor starters and other a-c. equipment.

A thyratron or ignitron is also an on-off device. However, the gas tube is fundamentally a high-voltage, low-current device, whereas the transistor is a high-current, low-voltage unit. A distinction of even greater importance is that the transistor possesses two great advantages over the thyratron which make its application much more flexible—it can carry or block currents in either direction, and it can be turned on or off at any desired instant. With proper driving circuitry, the transistor can be made to perform as a thyratron, but not conversely.

Field Controller

For example, a static field-control circuit that may replace rotating amplifiers and exciters is shown in Fig. 4. Advantage is taken of the fact that the transistor can pass current in either direction and, hence, can perform functions which are not now practical with thyratrons.

In this circuit, the base-drive circuits (not shown in detail) are such that transistors A and A′ are closed while B and B′ are open and conversely. If A and A′ are closed, the battery is connected across the field so that the field polarity is as shown; if B and B′ are closed, the field has the opposite polarity applied. Thus, this circuit functions similarly to a double-pole, double-throw reversing switch with the one outstanding difference that it can be thrown practically instantaneously. That is, the polarity of the field can be reversed without ever opening the field circuit. Thus, there will be no high-voltage surges and no discontinuities in the current. The average field-current can therefore be controlled by varying the ratio of the time that one polarity of voltage is applied to the field to the time the other polarity is applied; typical waveforms are shown. If the frequency of these rectangular voltage waves is high compared to the reciprocal of the time constant of the field, the field-current will have little ripple. This bridge can be held closed in either position and, hence, can apply full forcing to the field in either direction. A voltage regulator containing an exciter of this type would essentially contain only one time constant—that of the field winding itself.

Life Expectancy

Some early types of junction transistors had an unexpectedly high rate of failure. Investigation showed these failures were due primarily to faulty mechanical structure or moisture reaching the junction. Present techniques have eliminated these difficulties and modern units show promise of long life. There are few pertinent life test results available today because present designs are only about a year old. Units running continuously for this period have shown almost no failures. The life of transistors should be of the same order as power rectifiers. There are no known factors which would place an upper limit on life as long as the unit is operated within its ratings.

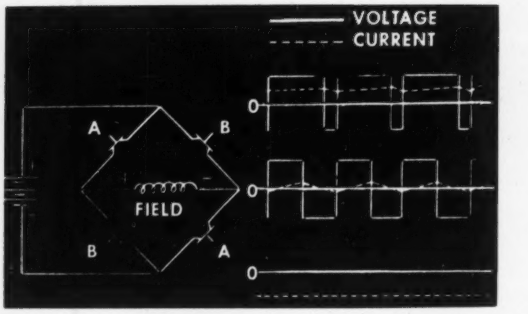

Fig. 4. A static field-control circuit using transistors. Typical wave-forms are shown on the right.

Most commercial transistors today are made of germanium and will operate as switches up to temperatures a little above 100 deg. C.; silicon transistors are becoming available and will operate at 200 deg. C. Thus, temperature limitations do not appear to be a problem.

It is too early to give cost estimates on power transistors. However, power diodes are now considerably cheaper than ignitrons of similar current rating, although they are slightly more expensive than ignitrons when compared on a power basis due to higher voltage rating of ignitrons.

Phototransistors

Another industrial application of transistors, and one which is fully practical today, is the use of phototransistors in place of photocells. A transistor of finger-tip size has a photosensitivity only slightly less than that of a photomultiplier tube, and far greater than any other available device. They are extremely sensitive to an incandescent lamp even when it is glowing only a dull red. Such phototransistors often are capable of operating rugged relays directly, with no intermediate amplifiers, and require only 6- to 12-volt supply. The extreme reliability and small size of this device may open up many more applications of light-actuated devices in the machine-tool control field.

New Theory of Extreme Values*

AIM of a statistical theory of extreme values is to explain observed extremes arising in samples of given sizes, or valid for a given period, or length, area, or volume, and to forecast extremes that may be expected to occur within a certain sample size, time, area, etc.

Three-Sigma Fallacy

The founders of the calculus of probabilities were too occupied with the general behavior of statistical masses to be interested in the extremes. The oldest remarks about such values seem to be due to Fourier who stated that, for the normal distribution, the probability of an absolute deviation to exceed 3½ times the standard deviation is about 1 in 50,000 and could therefore be neglected. From this small probability, the erroneous conclusion was drawn that about three times the standard deviation should be considered as the maximum for any statistical variate, for any number of observations. . . . However, the fallacy of this kitchen rule is obvious. If the initial variate is unlimited, the largest value is unlimited too, and if the *sample size* is increased, the *largest value* encountered will likewise increase. The question is *HOW?* For very *small* sample sizes, the three sigma condition is too *strong;* for the very *large* sample sizes, it is too *weak.*

The first studies of extreme values arose . . . from the need of astronomers to decide whether to accept or disregard an outlying observation that differs greatly from the rest. Another domain pointing to the theory of extreme values is gunnery . . . It is immaterial to the statistician whether he deals with *meteorological* extremes or *industrial* ones, whether he considers the life span of *human beings* or of *electric bulbs*, the *gusts* or the *excesses of the stock market.* In order to give an explanation of the *theory*, I will choose the floods as the *prototype* for the successful applications of these methods . . . .

Finally, allow me a word of warning. Since the early days of the calculus of probabilities, there has been a tendency to overestimate the importance of the normal distribution, as exemplified by Quetelet's theory of the "average man." It is true that the normal distribution is very important. But it is erroneous to assume that *all* distributions are normal or tend to normality. Within the theory of extreme values, most distributions are skewed, and do not cease to be skewed if the sample sizes are increased. The few distributions that are symmetrical are not normal.

Since the theory of extreme values is new, we should not expect complete solutions . . . I will introduce new concepts and tools necessary for the exact and asymptotic distributions of extremes that will be covered . . .

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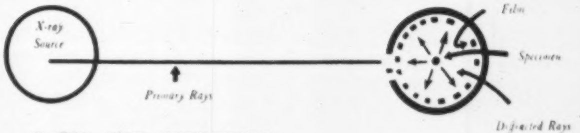
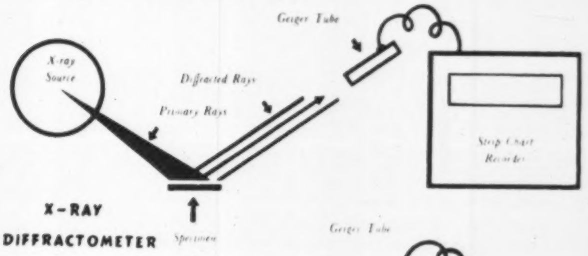
*Abstracted from "Statistical Theory of Extreme Values and Some Practical Applications," a series of lectures by Emil J. Gumbel, NBS Applied Mathematics Series 33, available from Supt. of Documents, U. S. Gov. Printing Office, Washington 25, D. C., Price: 40 cents.

Questions and Answers on X-ray Analysis

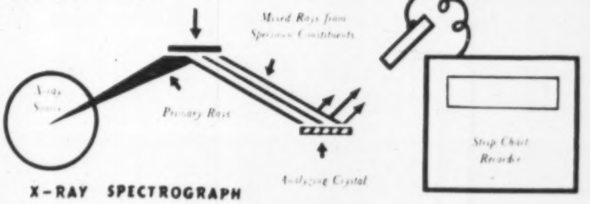
by VERN W. PALEN
North American Philips Co., Inc.



X-RAY FILM DIFFRACTION



X-RAY DIFFRACTOMETER



X-RAY SPECTROGRAPH

Question 1: What are the advantages of X-ray spectrometry and fluorescence analysis?

Answer: X-ray methods are nondestructive and can make quantitative and qualitative measurements of elements and compounds in minutes.

Question 2: What are the fields for X-ray analysis?

Answer: Metallurgy, corrosion studies, internal combustion engines, petroleum refining, mineralogy and geology, paints and protective coatings, ceramics and refractories, organic and inorganic chemistry, biology and pharmaceuticals.

Question 3: What are the basic principles of X-ray diffraction and spectrometry equipment?

Answer: An intense beam of X-radiation is directed upon a small specimen from which secondary beams of the same radiation are reflected by the atomic structure of the material. The reflected rays are analyzed for intensity and angular position; this information is converted into qualitative and quantitative data concerning constituents.

Question 4: What is X-ray fluorescence equipment?

Answer: In X-ray fluorescence, the induced secondary radiations are directed upon an analyzing crystal (rock salt, mica, quartz, or others) and intensities and angular positions are determined. The crystal serves as a grating to separate the various wavelengths representing the constituent elements.

Question 5: Basically, what can be done with diffraction spectrometry as contrasted to fluorescence?

Answer: Diffraction spectrometry looks into the atomic arrangement of a material, giving information on crystal geometry and structure. Patterns are representative of either elements or compounds; state of combination decides the ultimate curve. Fluorescence ascertains what elements are present and gives amounts, regardless of whether they are free, combined, or both.

Question 6: How are specimens prepared for the three X-ray methods?

Answer: Finely powdered specimens, solid sections, or liquids may be employed for work with the spectrometer or fluorescence. Camera diffraction requires powder coating on a suitable fiber or in a capillary, or the specimen may be a wire or small rod.

Question 7: Are difficulties involved in preparation of specimens?

Answer: Specimen preparation is simple if standard procedures are followed. Powders are usually sifted through a 400-mesh screen.

Question 8: What is the procedure when working with powder cameras?

Answer: A strip-film from the camera is developed, line intensities and spacings are observed. This information is compared with a card file giving data on many known compounds.

Question 9: What distinguishes spectrometer methods from those used in powder cameras?

Answer: A Geiger-counter tube takes the place of the film and, through electronic circuits, translates intensities and line spacings onto a strip-chart in the form of a curve.

Question 10: What are the advantages of the strip-chart method over camera and film technique?

Answer: The Geiger counter can read intensities and spacings faster and more accurately than can a person working with a film, a scale, and a densitometer. In addition, the strip-chart method eliminates difficulties due to film shrinkage and variations in darkroom procedure, not to mention the time saved. It also allows preparation of fragmentary charts, quickly giving information on selected significant areas of the diffraction pattern.

Question 11: Which method is best for a given set of working conditions and problems?

Answer: Where simple basic diffraction equipment must be procured or where specimens are minute, X-ray-camera methods are applicable. For research and production where speed is essential or where highest accuracy is required, the spectrometer is recommended; the latter can be adapted for fluorescence analysis, a procedure not possible by ordinary camera technique.

Question 12: How are liquid, gaseous, or vapor specimens handled when using X-ray analysis techniques?

Answer: When dealing with a liquid or solution, the material is placed in an open-faced holder; in gaseous or vapor form, the specimen usually is flowed past the beam.

Question 13: What is the particular field of application for fluorescence analysis?

Answer: It is especially suited for quantitative work with elements, irrespective of chemical or physical state. All elements above sodium in the atomic scale may be checked, sensitivity varying in accordance with the characteristic wavelengths. The method is distinguished by its ability to give excellent results in higher-element concentrations.

Question 14: What is the time required for a fluorescence-analysis determination?

Answer: Time required to determine one element depends on two factors—strength of reflection of the element, and percentage of error allowable. A line giving an intensity of 2000 counts per minute would require about 3 minutes counting time to obtain sufficient counts to reduce the probable error to 1 percent.

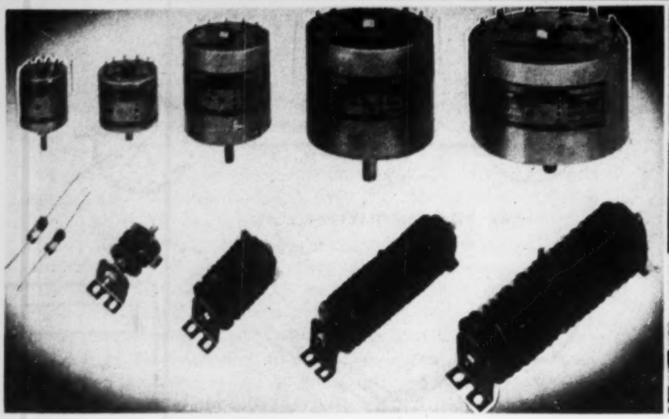


Fig. 1. Selenium rectifiers and small amplifiers.

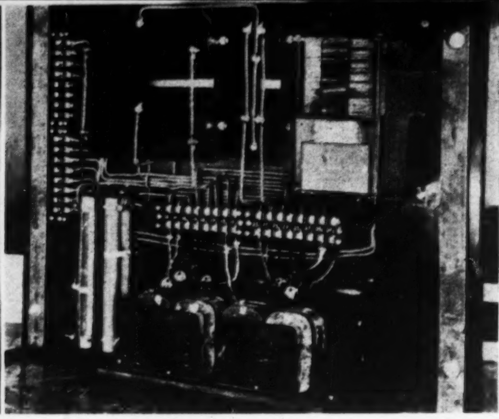


Fig. 2. Small "Magamp" control panel.

Industrial Applications of MAGNETIC AMPLIFIERS

Inherent reliability, simplicity, and ruggedness of magnetic amplifiers assure an expanding field of application in industrial control of high-power motors.

by C. G. HELMICK
Westinghouse Electric Corp.

ALL INDUSTRIES, including machine tools, now require better control performance, closer accuracy limits, and greater over-all reliability. Emphasis is placed on reliability because of the increasingly greater investment that depends on the successful operation of the controlled system.

Maintenance and reliability are the qualities which have focused the limelight on magnetic amplifiers. As magnetic amplifiers are static devices, practically no maintenance is required. Magnetic amplifiers are composed of iron cores, windings, and dry-type rectifiers. All these components are inherently long lived and invulnerable to normal industrial abuses. Figs. 1 and 2 illustrate the components involved and their packaging in industrial units.

Better core materials with so-called "square-loop" characteristics have been developed. Good dry-type rectifiers are available. The key which unlocked the application door was development of the self-saturating circuit, which uses rectifiers to increase amplifier gain tremendously. Although the principles of operation of magnetic amplifiers have been known for many years, it was only recently that they have come into widespread use.

Principle of Operation

Functionally, the magnetic amplifier is a variable reactance placed between the load and its power supply. By means of a small control signal, the reactance can be varied by as much as 100 to 1 with commercially available materials. Likewise, the voltage across the load is varied by the same amount.

To understand simply what goes on inside a magnetic amplifier, recall that the voltage across any reactance is proportional to the rate-of-change of magnetic flux in the iron. If the iron saturates, the flux can no longer change and the reactor voltage collapses. The core is said to have "fired." By use of the d-c. control windings, the degree of saturation is pre-set, and thus, so is the point at which the core will reach saturation, or "fire." Note in Fig. 3 that if the flux is pre-set to a lower value, it takes longer to get back up to saturation. Thus the core "fires" later and the output is reduced.

All of the circuits to be discussed are of the self-saturating type, which means only that the load winding has a rectifier in series with it. This prevents demagnetizing the core during the negative half cycle. The control characteristic curves for such an amplifier are shown in Fig. 4. There is a rather steep linear region to these curves, and it is in this linear region that a gain and time constant are defined. The gain is proportional to the slope of the curve.

Gain Vs. Time Constant

The desired gain can be designed into a magnetic amplifier by proper choice of control winding ratios, or by use

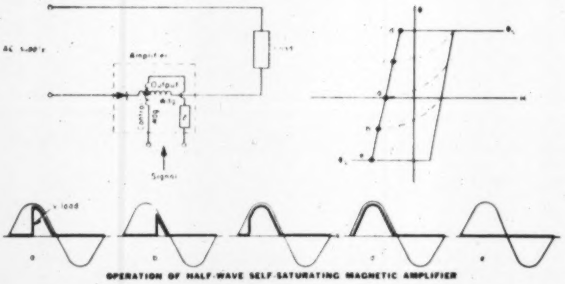


Fig. 3. Half-wave saturating characteristics.

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* Presented at the 18th Annual Machine Tool Electrification Forum, sponsored by the Westinghouse Electric Corporation, Buffalo, New York, April 6 & 7, 1954.

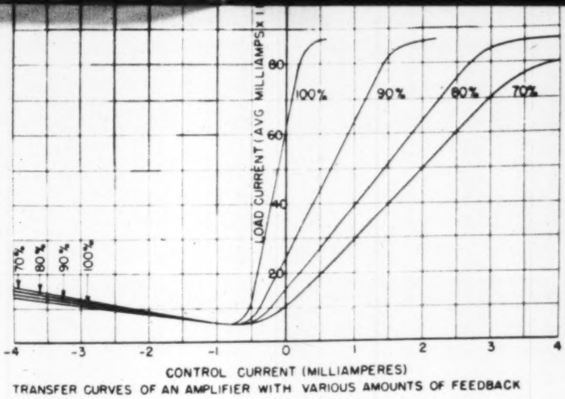


Fig. 4. Transfer curves for self-saturating magnetic amplifier.

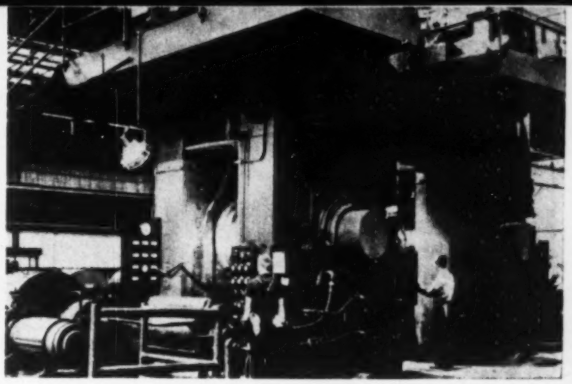


Fig. 6. Two-stand temper-pass mill.

of suitable feedback. It is fundamental, however, that high gain comes at the sacrifice of response time. Thus, to obtain fast response, the power gain must be kept reasonably low. This may mean extra stages of amplification for some applications. For example, the gain of a typical toroidal-core magnetic-amplifier might be 500 with a response time of three cycles. The gain could be made as high as 10,000, but the response time then might be as high as 50 cycles. To evaluate the performance of such a device, we speak of a figure of merit—the ratio of power amplification to response time. This figure of merit is relatively constant over a wide range of designs.

Gain and time constant are characteristics of any amplifier—magnetic, electronic, rotating, or other. With electronic amplifiers the time constant is usually small enough to neglect, at least in most industrial applications. To obtain the same fast response with magnetic amplifiers, 400-cycle supplies are used; a three-cycle delay is thus less than 1/100 of a second and usually can be neglected.

Push-pull Operation

Like electronic amplifiers, magnetic amplifiers have the basic limitations of non-reversible output. When an application requires a reversible output, two amplifiers may be arranged in "push-pull." In this manner, one unit provides the positive output while the other unit provides the negative output (Fig. 5). The "push-pull" scheme results in a theoretical maximum efficiency of only 17 percent, and is therefore normally restricted to low-power requirements. Preamplifiers for reversing applications are often "push-pull" units.

A more efficient but more costly method is to use two independent amplifiers working into separate fields on an exciter or generator. By thus controlling field excitation, the output voltage of the exciter may be varied smoothly from maximum positive voltage, smoothly through zero, to maximum negative voltage. It is well known, of course, that a rotating amplifier includes this feature inherently. While reversing applications may require two amplifiers, there are many applications which do not; examples of systems which use single-polarity control are voltage regulators, speed regulators, special computer circuits, and limiting circuits.

Limiting circuits, for example, are very important in regulator systems, especially when forcing action is required to effect fast response. If field forcing is used on the field of a d-c. machine to obtain rapid response, the action may be so rapid that dangerous currents will circulate. To prevent this, a current-limit magnetic amplifier can be used to throttle the forcing when the armature current reaches the maximum safe value. If a magnetic amplifier is already being used, say as a speed regulator, one additional winding on the amplifier may be utilized for current limit override. By utilizing suitable control signals, other quantities such as torque, speed, and voltage can be limited in a similar manner.

Applications

Fig. 6 shows a two-stand temper-pass mill for tempering steel strip after annealing. The drive requirements are that the tension in the strip be controlled closely. To accomplish this, strip tension is measured by a tensiometer. As the strip bears directly against the tensiometer roll, any change in tension causes movement of the roll. This roll movement is converted to an electrical signal and fed to the control winding on the magnetic amplifier (Fig. 7).

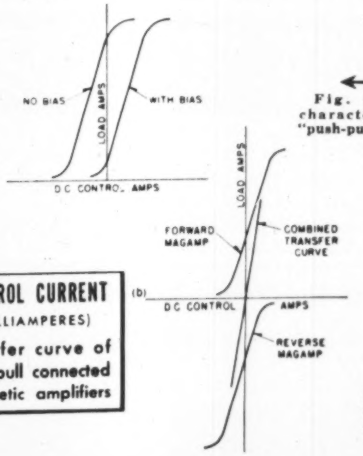


Fig. 5. Control characteristics for "push-pull" amplifier.

CONTROL CURRENT
(MILLIAMPERES)
Transfer curve of push-pull connected magnetic amplifiers

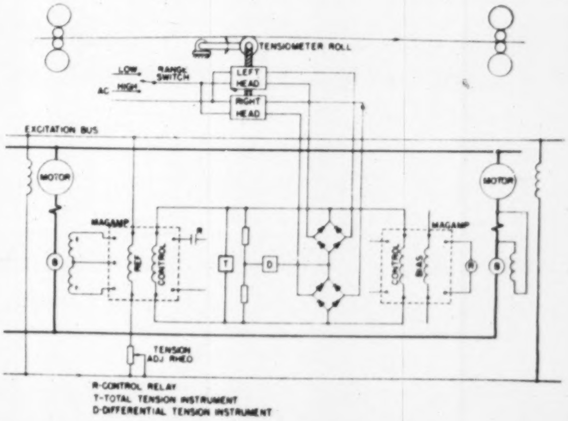


Fig. 7. Schematic diagram for temper-pass mill control.

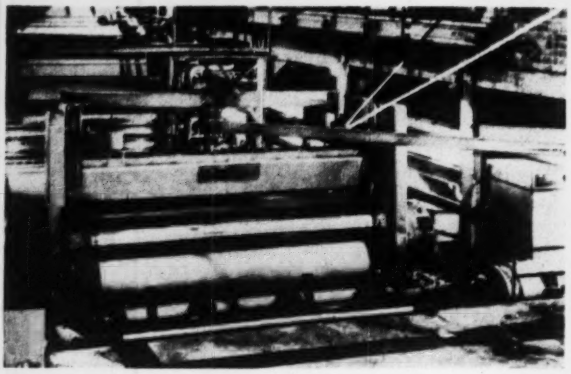


Fig. 8. Five-thousand-fpm. paper winder.

The control signal is compared against the tension reference signal, to control the output of the magnetic amplifier. The amplifier works into the field of a booster which changes the drive-motor speed in such a direction to return strip tension to its original set value.

Another application of magnetic amplifiers has made possible the operation of a modern paper winder at the unprecedented speed of 5000 fpm. This winder (Fig. 8) receives 17-ton rolls of paper as they come from the paper machine, and operates to produce many smaller rolls more suitable for shipping and handling. Referring to Fig. 9, the surface winder is seen to pull the paper from the core-type unwind stand. Braking on the unwind stand is carefully controlled by a braking generator to maintain constant tension in the paper.

For a fixed linear paper speed, the unwind roll speed increases as its diameter shrinks. To keep the tension constant under these conditions, it is necessary to hold armature-current constant. Notice that the unwind tension regulator measures the current to the braking generator, compares it to a reference as set on the tension rheostat, and controls the generator excitation accordingly.

The booster is used to compensate for IR-drop and to provide tension current when the winder is at standstill. Three auxiliary magnetic amplifiers are shown. One provides a slow, regulated speed for threading operations. The other two units provide a current-limiting action during acceleration to full winder speed. Thus the machine is accelerated and decelerated as rapidly as possible without circulating dangerous currents.

Another application which demands the utmost performance from its regulated drive is a modern, high-speed reversing planer (Fig. 10).

These applications are but a few of the many magnetic amplifier regulators which have been built.

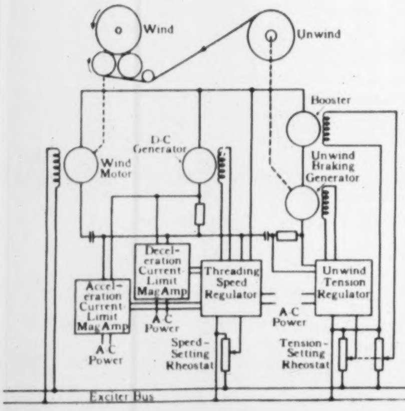


Fig. 9. Control system for paper winder.

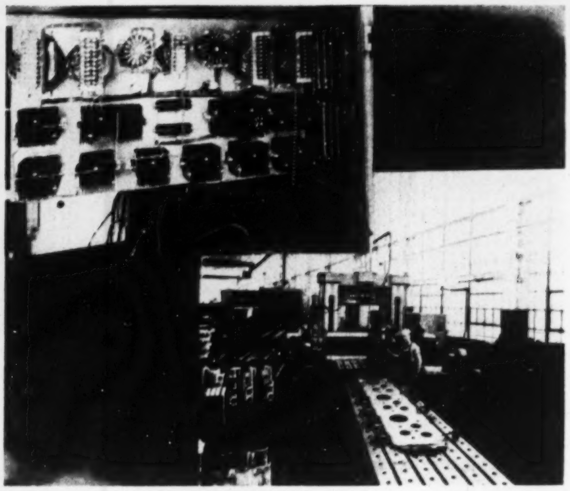


Fig. 10. High-speed reversing planer.

Limitations

It is well to know both the limitations and strong points of the magnetic amplifier to evaluate its application to a specific job.

Limitations of the magnetic amplifier may be listed as follows: (1) Single-polarity output. (2) Finite minimum time delay, depending on supply frequency. (3) Finite minimum signal level required. (4) Incomplete cutoff sets minimum output. (5) Somewhat temperature sensitive (over wire ranges). (6) Somewhat sensitive to variations in supply voltage and frequency.

Advantages

On the other hand, the strong points of magnetic amplifiers include these advantages: (1) Static device with long life and minimum maintenance. (2) Shock resistant. (3) No warm-up period required. (4) Control windings isolated from each other and from the load windings. (5) Flexibility. (6) Fast response. (7) Device acts as variable reactor, not resistor; therefore more efficient.

Use of magnetic amplifiers is spreading rapidly. In addition to applications described, magnetic amplifiers have been used in the paper industry on sectional paper machine drives, super-calendars, and core-type reel drives. The lumber industry is using log carriage drives and veneer lathe drives with these static control devices. The steel industry has numerous installations including tandem and non-reversing mill main drives, tandem-mill reel drives, processing-line speed regulators, pickle-line loop regulators, and others. All-magnetic-amplifier voltage regulators have been used in central stations. Mine hoists, power shovels, a-c. cranes, and printing presses have employed magnetic amplifier control.

A knowledge of the capabilities of magnetic amplifiers plus a knowledge of what they are already performing for other industries, will undoubtedly stimulate their use in the machine-tool industry. For example, the paper industry uses a magnetic-amplifier speed regulator on a super-calendar drive which provides a speed range of 40 to 1 by armature voltage control. Possibly this regulator could be modified for use as a table feed drive, say for a large planer-type milling machine. By using motor field control, this range could be extended considerably.

As more people become familiar with magnetic-amplifier applications and gain more experience with them, the field will grow. With the inherent reliability, simplicity, and ruggedness of the magnetic amplifier, control and design engineers are certain to utilize it in the ever-expanding field of regulated systems and automatic controls.

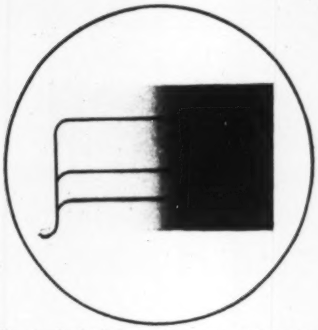


Fig. 1. Cathode-ray tube and gray wedge.

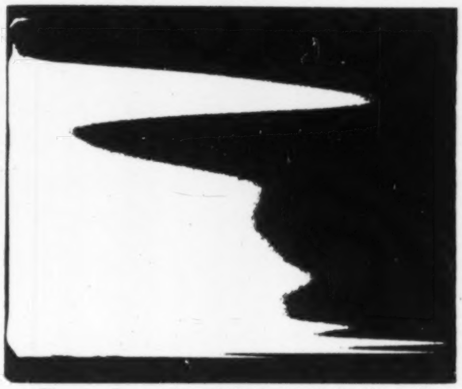


Fig. 2. Gray-wedge photograph of Caesium 137 spectrum.

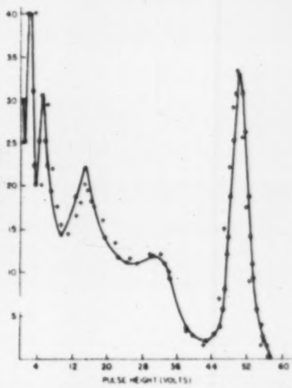


Fig. 3. Comparison of gray-wedge scintillation spectrometer curve (solid line and dots) with single-channel scintillation spectrometer (crosses).

Gray-wedge technique for PULSE-HEIGHT ANALYSIS

Pulse-height analysis is a basic part of scintillation spectrometry. The gray-wedge pulse-height analyzer offers a simple and accurate solution to a difficult problem.

by W. A. HIGINBOTHAM
Brookhaven National Laboratory

SCINTILLATION DETECTOR consists of some sort of phosphor (which emits a pulse of light when bombarded by a photon or energetic particle) mounted on a photomultiplier tube. Thallium-activated sodium iodide is the best available phosphor for detection of gamma rays. Various organic crystals, such as anthracene, are preferable for detecting beta rays. Other materials are used for neutrons, for alpha particles, and for special applications.

The pulsed light output from a phosphor is proportional to the energy lost in the phosphor by the initiating ray. A scintillation counter may be combined with a pulse-height analyzer to form a spectrometer, provided that all the radiation energy is dissipated in the crystal. To be useful, such a system must maintain a high degree of linearity and stability throughout.

One element of the system is the pulse amplifier. In addition to the requirements of stability and linearity, there is a serious overload problem. It is not unusual to wish to count the pulses in a certain energy interval in the presence of pulses a thousand times larger. The importance of good overload properties in a pulse amplifier for use with scintillation or proportional counters can hardly be overstressed, even for routine counting applications.

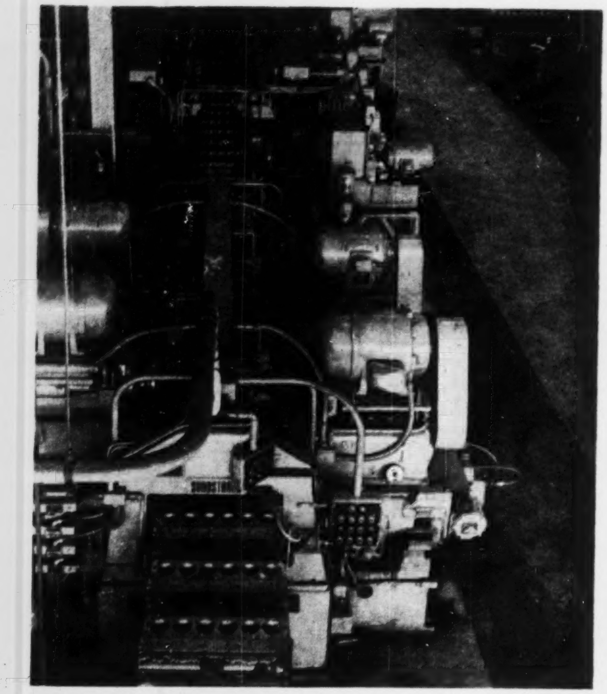
For the past three years we have been primarily concerned with pulse-height analyzers of the gray-wedge type, which work in the following manner: Pulses from an amplifier are passed through a stretcher and displayed on a cathode-ray oscilloscope with triggered sweep. At the end of the sweep the stretcher is discharged. The intensification is delayed so that each pulse produces a straight, horizontal line across the scope at a vertical displacement corresponding to the pulse height. A mask of variable density is placed in front of the tube face, which has complete transmission on the left and tapers off to, say, 1-percent transmission on the right (Fig. 1). The display is photographed for a time which includes a large number of events. The larger the number of pulses occurring at a given vertical level, the farther to the right will the film be exposed. The mask is made by grinding neutral filter glass to a wedge shape, which accounts for the name given the analyzer. With a linear wedge it turns out that the distance the film is darkened is proportional to the log of the number of pulses at a given height. A photograph of the spectrum of Caesium 137 is shown in Fig. 2. As we operate the cathode-ray tube with sweep horizontal and pulse-height vertical, the vertical axis is the energy scale, and the horizontal axis is the log of the number of counts.

Fig. 3 is a linear plot of number vs. energy. The axes have been exchanged. The solid line was obtained from the preceding gray-wedge photograph, while the dots and crosses are points taken with a single-channel analyzer.

The gray-wedge analyzer is a simple device compared to other multiple-channel analyzers; it consists of a pulse stretcher, a cathode-ray tube with triggered sweep, the wedge and a camera. The new flat-face 5-inch cathode-ray tubes have so little distortion that the photographs may be read directly through a semi-log paper grid. The indication is continuous rather than discrete, as in a channel device. While it cannot be exactly compared to a channel instrument, the resolution achieved is equivalent to 100 or more channels. The problems of channel-width calibration, channel-width stability, gaps or overlap between channels, which are critical in a multichannel analyzer, do not exist here. The position of peaks on the energy scale can be determined with a high degree of accuracy. The chief limitation of the gray-wedge method is in quantitative measurements of number of pulses in a peak. This limitation is imposed by reciprocity failure of photographic film.

Abstracted from the paper "Brookhaven Electronics Instrumentation Paper Program," Convention Record of the IRE, Part 9—Medical and Nuclear Electronics, Institute of Radio Engineers, 1 East 79 St., New York 21, N. Y.

Machine-tool



Engine block castings are fed automatically into these transfer machines at Ford Motor Company's new engine plant at Cleveland. Section in foreground is a five-station machine that mills both ends of block. In the background is a 30-station machine that performs a series of milling, drilling, chamfering, and tapping operations.

"Electric brains," or nerve-centers, direct the automated lines that machine and process completely engine blocks, cylinder heads and other parts at Ford Motor Company's new Cleveland Engine plant. Unit shown receives information continuously from electric switches in the production department. It compiles the data, makes the best possible decision as to a course of action, then directs the power to work giant arms and fingers of steel which automatically pick up, turn, and move from one automatic machine to another large components such as 180-pound engine blocks.

A revolution in materials processing has been going on in automotive plants from coast to coast. What started as a major revamping of stamping methods and engine machining has spread to every major production department, backed by investments totaling hundreds of millions of dollars.

Results so far include faster production, closer tolerances, more rigid (and often automatic) inspection, reduced space requirements, lowered unit costs, reduced overhead and better working conditions.

Throughout the industry, the battle lines are drawn between traditional methods of manufacture and vastly improved or entirely new methods.

In 1912, it took 162 machines to finish the four flat faces of 108 cylinder heads an hour. By 1946, the same output was being achieved from six machines. By 1953, these six machines were outproduced by one huge horizontal broach—and from 1912 to 1953, total investment in needed machines *dropped* from $243,000 to $230,000. What changed?

One of the essential elements of the new processing method, dubbed automation, is the virtual elimination of human physical effort from the manufacturing process. This is further exemplified in the huge transfer machines now found in many plants.

Basically, transfer machines consist of a series of individual machines, each equipped for automatic loading and ejection, linked to each other by conveyor systems, with the whole controlled by recently-developed electronic, hydraulic or mechanical "brains."

Automation was originally applied chiefly to machining. Now the concept extends far beyond the engine plants where it gained early success. Automatic techniques in work handling and production are now applied to foundry core-making, forging and pressing, heat treatment, painting, and plating. Just coming into the picture in a major way is the development needed to complete the major outlines of this revolution in processing: Automatic assembly. So far, production applications have been limited to small parts, such as radiator caps.

It will require tremendous effort to bring automatic assembly to major units—to design into steel the flexibility

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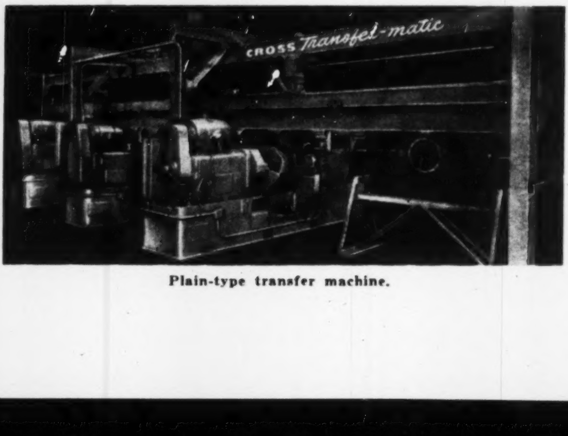
*Abstracted from *Automobile Facts,* Vol. 13, No. 1.



Plain-type transfer machine.

Automotion

of the human arm and fingers, directed by the human brain. But it eventually will be done.

All these developments do not mean that the pushbutton plant is just around the corner or even on the horizon. They do mean that men are being progressively shifted into jobs that demand less muscle and more brain. The unskilled laborer is going to be less and less in demand in the automotive industry, while the market for skilled labor continues to grow apace.

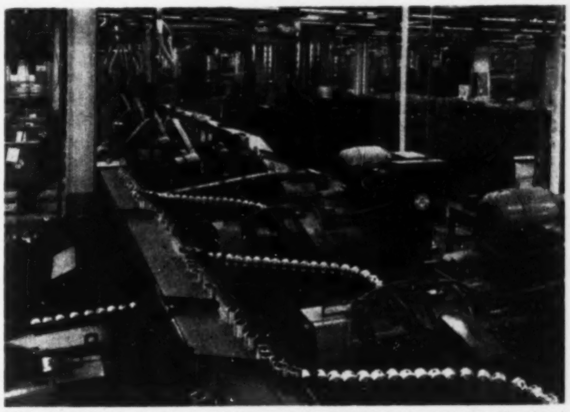
The progressive removal of workmen from close physical contact with heavy materials is making plants constantly safer—and they were already safer than the average home.

More men and women drew more money for work on automotive company production lines in 1953 than in any previous year in history.

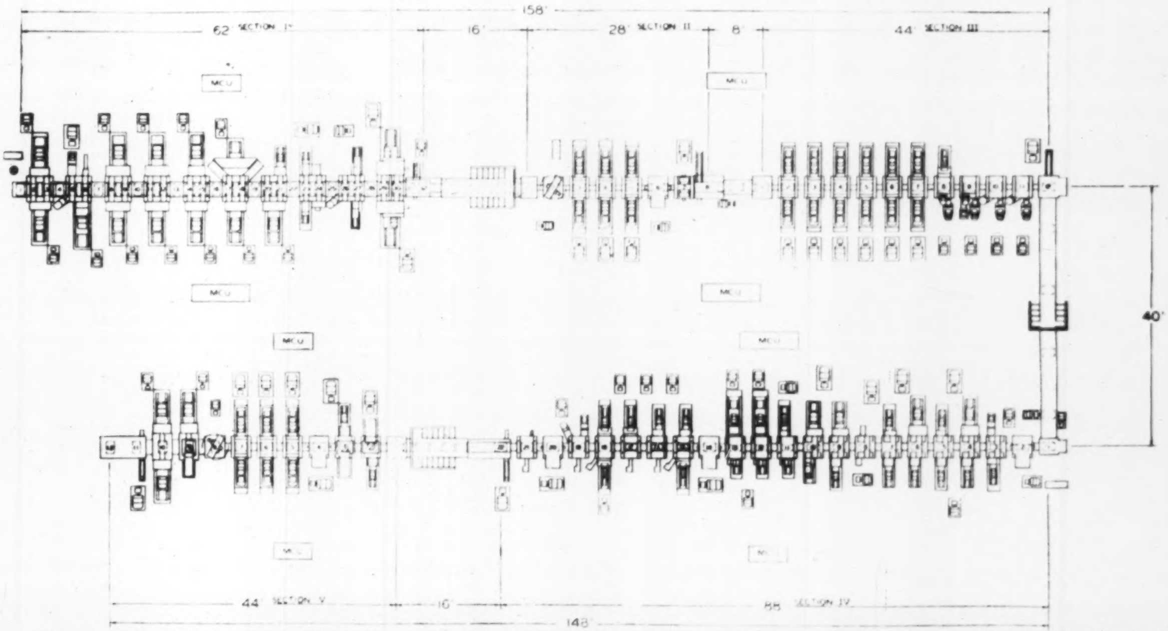
The technological advances of the past eight years played a major role. They enabled automotive firms to hold production costs within reason in the face of rising wages, taxes, materials costs and capital investment. By conserving floor space and increasing productive capacity, they enabled car and truck makers to maintain attractive prices, increase the market for their products and lay the groundwork for still further expansion.

The year ahead should see a continuation and acceleration of the trends established in the postwar period. If so, Americans will continue to get better values for their investment, not only in cars and trucks, but in products of other industries to which this processing revolution is spreading.

Water-jacket cores for Ford six-cylinder overhead-valve engines are made of prepared core sand by this newly developed five-station core-blowing machine at Ford Motor Company's new foundry in Cleveland. Operator at left is unloading finished core which has been formed by air-pressure. Core-drier fixture is being placed over blown cores by operator in center. Cores are placed on conveyor in background for transfer to drying ovens.



Machining of aluminum pistons at Ford Motor Company's Cleveland engine plant requires 25 machines so tied together by automation equipment that the work is completely automatic. Pistons are carried along a conveyor belt system which moves pistons in and out of the machines. When the pistons are machined, they are dropped onto the bottom conveyor and are moved to the next series of machine operations.



"Transfer-matic" cylinder-block-machining line with length of 346 feet, 539 operations, and 100-parts-per-hour capacity, all under the control of one operator.

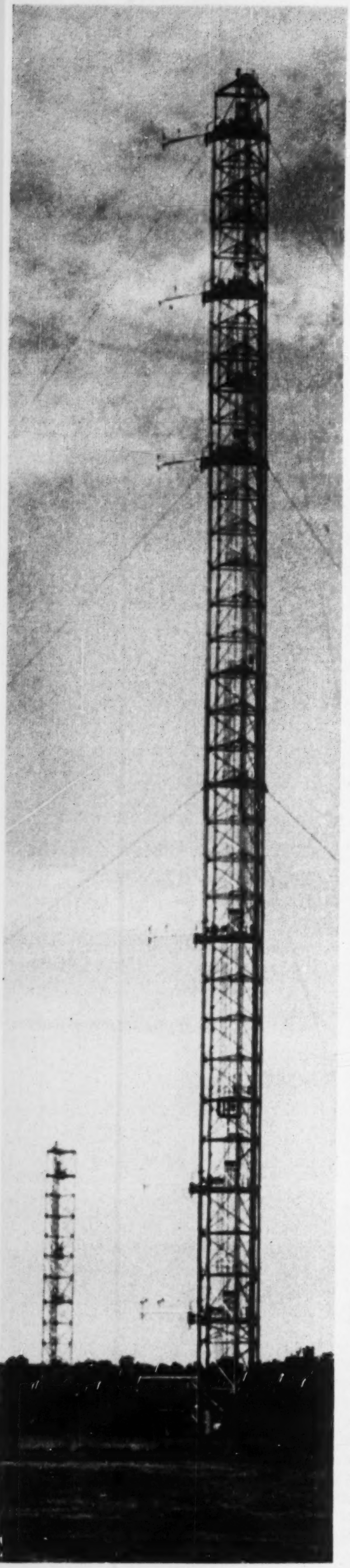


Fig. 1. Ace and King towers.

AIR-TEMPERATURE

on a 420-foot tower

by DANIEL A. MAZZARELLA and DONALD K. KOHL
Brookhaven National Laboratory

Continuous measurements* of the ambient air temperature have been made on a 420-ft tower at Brookhaven for nearly four years, as required by associated reactor operations. The sensing elements consist of Leeds and Northrup resistance thermometers ("Thermohms"), housed in radiation shields and aspirated by a central pump. A twelve-point, triple-range recorder effects successive measurement of temperature at each level. Two "Model R" Leeds and Northrup instruments record the differences in temperature between the top of the tower and its base, and between the top and an intermediate level.

There are eight working levels on Ace tower (Fig. 1), each equipped with a boom which can be rotated through a 315-degree arc. These booms support numerous instruments, among which are Leeds and Northrup 100-ohm copper "Thermohms, Type 8195-10-S" specially calibrated to ±0.1-degree Fahrenheit in the range from -30 to +50 deg. C. All "Thermohms" are made with lead-covered leads, 18 to 24 inches long, with the end of the coverings sealed in to prevent sweating. Three-lead elements are used in all absolute temperature measurements and four-lead or two-lead thermometers, matched in pairs, are installed in the difference-measuring circuits.

Each sensitive element is centered within a radiation shield and located at the outboard end of its respective boom (Fig. 2). Most of the levels are equipped with a single housing for direct-temperature measurements. Dual housings, for both absolute and difference measurements, are located at three levels. Each housing, single or compound, is connected to the boom and the aspirating system by a T-shaped fitting (Fig. 3). At the junction between the tee and the boom, an air seal is effected by means of a large bakelite plate. The thermometer leads extend through a rubber grommet in the bakelite. An air-metering disc with an orifice of 11/32 in. is fitted between the horizontal arm of the tee and a tube connecting to the main aspirating riser through a swivel fitting. A gate valve at each level beyond the swivel provides for manual metering adjustments.

A single pump and motor furnish the vacuum for aspirating all thermometers. The pump is a Nash "Type L-4 Hytor," with 10-horsepower 3-phase motor. It has a capacity of 200 cfm. and can produce a vacuum of 12 inches of mercury. The controls are adjusted for an operating vacuum of 9 inches—equivalent to a flow of 21 cfm. at the housings, a linear velocity of 21 ft./sec., or 14.3 mph. at the temperature-measuring elements.

Temperature Recorders

Sequential measurement of temperature on each level is accomplished by the "Thermohms" through a Leeds and Northrup triple-range, twelve-point "Micromax" indicating recorder (Fig. 4, lower right). The measuring circuit (Fig. 5, lower) consists of the M. E. Leeds double-slidewire bridge[1], and the three-wire arrangement of Siemens[2] for making the measured resistance independent of the lead wire length or temperature. A 1-to-1 ratio balance in the bridge is maintained through mechanically operated slidewires.

Several special design features add to the usefulness and accuracy of this recorder. A simple plug-and-block arrangement in one arm of the bridge extends the conventional single-range recorder to one with three overlapping ranges: -30 to +10 C., -10 to +30 C., and +10 to +50 C. Another plug and block arrangement is wired to three manganin-wire check coils, each of which corresponds to one of the above ranges. The coils are wound to a resistance equalling 95 percent of full scale. An additional reference point has been furnished for the two ranges from -30 to +30 C. This consists of a check coil for the 0 C. value.

Inaccuracies of individual "Thermohms" and of the recorder are compensated by individual compensators installed for each of the twelve points. These consist of manganin-wire variable resistors which can be adjusted on a scale of 0 to 100 divisions (one di-

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* Research carried out under the auspices of the U. S. Atomic Energy Commission.

MEASUREMENT

Meteorology operations at Brookhaven include two towers equipped for air-temperature measurement at various levels. Important factors include characteristics of "Thermohm" detectors, radiation shields, aspirating system, and calibration technique. Mention is made of lightning protection.

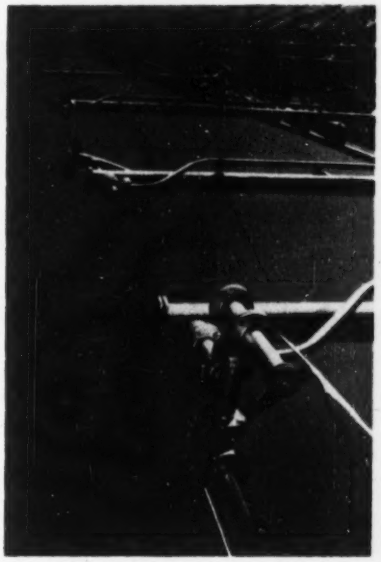


Fig. 2. Side view of Ace, showing outboard end of booms.

vision is equal to 0.02 C.). With the compensator set on the mid-point, the indicated temperature can be varied ±1 C.

A complete cycle is printed every 345.6 seconds (5.8 minutes), with an interval of 28.8 seconds for each point. It is recorded at a speed of four inches per hour on a No. 3 Leeds and Northrup strip chart. The paper is ruled to 80 divisions over a width of 10 inches. Hence each degree of the 40-C. ranges has a linear spread of 0.25 inch.

The triple-range circuit, using a simple plug-and-block arrangement in one arm of the bridge, represents a compromise in construction at the expense of a small inaccuracy. As the resistance-temperature curve of copper "Thermohms" is nonlinear below zero degrees, one would expect an overlapping range circuit to display large errors at the colder temperatures. Actually, an attempt was made to distribute the error somewhat evenly over the three ranges. The error is -0.06 C. at 10 C. on the low range, +0.04 C. at high end of middle range, and +0.03 C. at high end of high range. This gives a maximum error of 0.15 percent on the low range; errors on the other two ranges are 0.15 percent or less.

The over-all accuracy of the "Model S" recorder is ±0.2 percent of scale, or 0.08 C. Of this amount ±0.1 percent of scale, or 0.04 C., is the sensitivity of the recorder; changes of this magnitude are within the response of the instrument. These figures surpass the usually quoted accuracy of 0.33 percent of scale for production-line "Micromax" recorders.

Temperature-difference Circuit

The two L & N "Model R" temperature-difference recorders are shown in Fig. 4, left. The measuring circuit (Fig. 5, upper) consists of a self-balancing d-c. Wheatstone bridge. A change in temperature at one, or both, of the elements causes the slidewire to seek a new position. Loops L_1 and L_2 (in opposing arms of the bridge circuit) provide compensation for the dissimilar lead lengths to the "Thermohms" on the tower. Initially, four-lead elements were used in these circuits. Equally satisfactory results have been obtained with two-lead "Thermohms" provided the respective pairs of leads are measured to an accuracy within the compensating limits of the recorder.

Precise position of balance with both "Thermohms" at the same temperature is obtained by compensator S_1 on the wiring diagram. This adjustable dial is calibrated to 100 divisions; this coil has a resistance of 0.2 ohm, with a range in temperature equivalent of ±0.5 C.

The "Model R" record is printed as a continuous line of temperature difference in the range from -5 to +15 C. Absence of a difference between the two tower levels represents an isothermal condition. When the temperature decreases with height (a temperature lapse), the trace is displaced toward the center of the chart. When the temperature increases with height (a temperature inversion), the indicating arm moves clockwise and the pen describes a line outward, toward the chart periphery.

Each "Model R" recorder system has an accuracy of ±0.03 C. The recorder is accurate to 0.3 percent of scale, or ±0.03 C.; the matched pairs of "Thermohms" are correct to ±0.1C. However, the inaccuracy of differing resistances in the temperature elements and the errors in lead-wire resistance are eliminated by the compensating zero, adjustable coil.

Characteristics of "Thermohm"

Construction details of the "Thermohm" have been given[3, 4]. In comparison to the mercurial thermometer normally used to measure air temperature at a conventional weather station, the "Thermohm" element is larger and more massive.

Lag Coefficient

If a body of temperature T_1 is suddenly immersed in cooler air of temperature T_0 deg., the body gradually becomes cooler. Its temperature (T) after t minutes is given by Newton's law of cooling:

$$T = T_0 + (T_1 - T_0)\, e^{-t/\lambda}$$

where λ is a constant frequently called

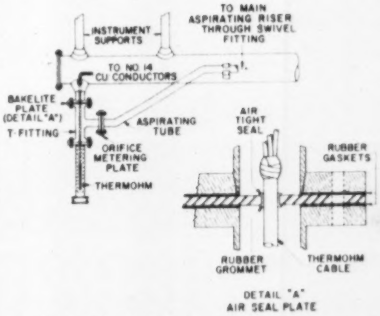


Fig. 3. Sketch of fitting between housing and boom.

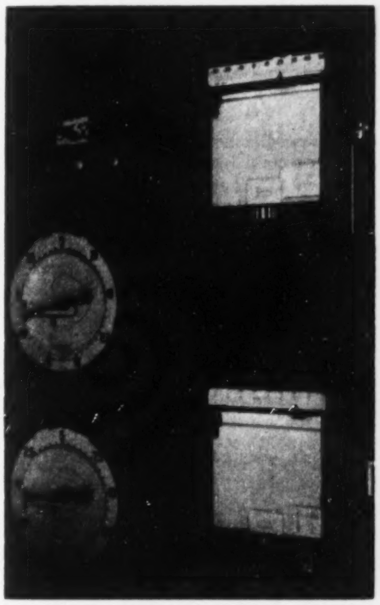
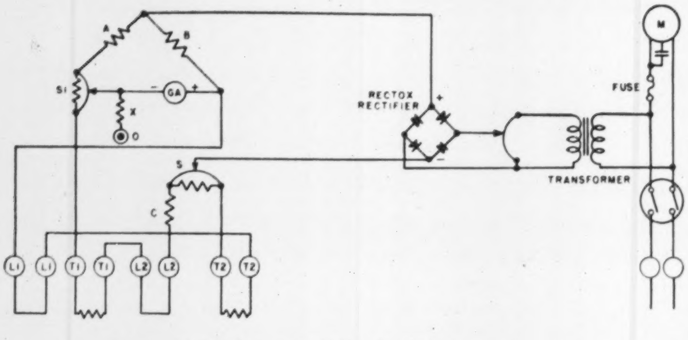
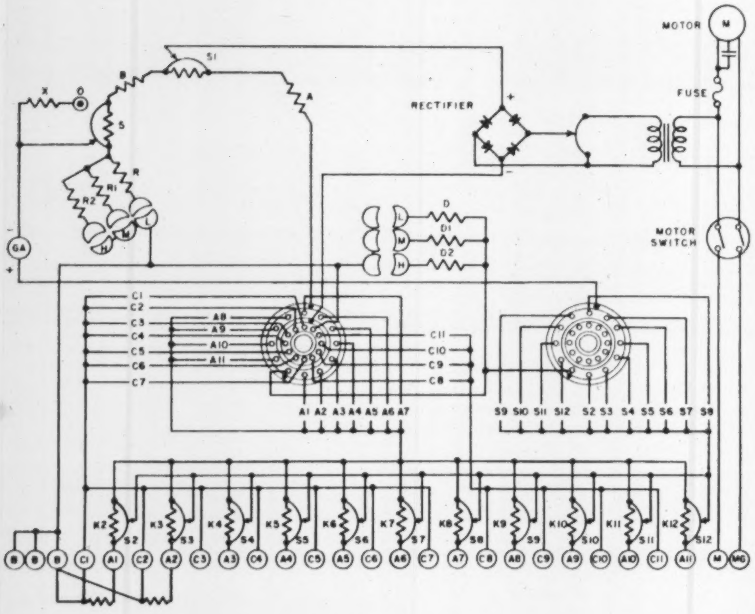


Fig. 4. Recorder panel, temperature section. At left are the temperature-difference recorders.



MODEL R, TEMPERATURE DIFFERENCE CIRCUIT



TWELVE - POINT MODEL S CIRCUIT

Fig. 5. Top, "Model-R" temperature-difference circuit; bottom, 12-point "Model-S" circuit.

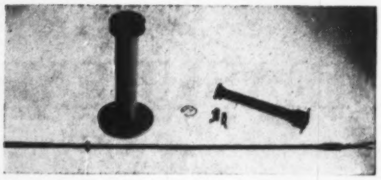


Fig. 6. Radiation shield.

the lag coefficient (λ), or time-lag constant (or time for 63.2 percent of total variation to occur).

Tests were conducted to ascertain the lag coefficient of the "Thermohm," as related to the rate of ventilation. The trials were conducted with the "Thermohm" and radiation shield.

A source of heat (a light bulb) was hung from the bottom of the shield. When the temperature ceased to fluctuate, the box was removed, thus exposing the element to the cooler, unchanging temperature of the tower pit. The findings of these tests, in the ventilation range from 1 to 30 ft./sec., are given in Fig. 7. The general results are in agreement with Middleton[1], who indicates that the response of a thermometer varies with ventilation according to the relationship

$$\lambda = Kv^n$$

where λ is the lag coefficient, v is the rate of ventilation in m./sec., K is a constant and n is an exponent which varies according to the size and characteristics of the bulb. Middleton has shown that "for dry thermometers n is in the neighborhood of -0.5, rather less for thermometers of simple form, and greater for thermometers which themselves set up a good deal of turbulence." It was found in the tests herein reported that the value of the exponent for the Thermohm was less than -0.5. The equation of the curve in Fig. 7 is:

$$\lambda = 232v^{-0.377}$$

Under normal operating conditions at Brookhaven the "Thermohm" in its radiation shield responds to ⅔ of a sudden change in temperature in 72 seconds. Response of a mercury-in-bulb thermometer offers an interesting comparison; when aspirated at 21 ft./sec. the time-lag constant of this element is calculated to be 49 seconds (based on the data presented by Middleton[1] for a spherical bulb with a diameter of 1.12 cm.). Sharp increases in the recorded temperatures result from an inoperative aspirating system. The magnitude of the errors depends on the weather conditions associated with each situation.

Radiation Shield

Equally important is an effective radiation shield to eliminate direct effects of either solar or terrestrial radiation.

The "Thermohm" radiation shield described (Fig. 6) is an improvement in design of a model suggested by Dr. T. B. Drew, for use in the meteorology section of the Hanford Engineer Works[7]. It is constructed of aluminum; the parts are anodized in a chromic acid bath. A durable surface finish was found in a stainless-steel paint. As it was gray in color, tests were conducted to determine the reflective characteristics of this paint, as compared to aluminum paint. Results obtained with a "Type D.W.-60" General Electric radiation meter indicated the superior reflective characteristics of the aluminum paint, which was applied as a final coat. Total solar and sky radiation, measured 900-ft. from Ace tower with a 10-junction Eppley bulb, also was measured in this analysis.

Effectiveness of the radiation shield was tested further by making simultaneous measurements from two housings, in close proximity, and at the same level (Fig. 2, lowest boom). Each of the elements was wired to a single six-point "Micromax," so that alternate printings of temperature could be obtained every 28.8 seconds. A calibration of the "Thermohms" in a water bath showed both elements to read the same. Thus, numerous tests designed to measure the effect of sunlight, shade, infrared, wind, etc. were conducted over a period of several weeks. The results were inconsistent. This led to a detailed analysis of the experimental equipment and procedure. The element and housing were found to be somewhat discolored by continuous use at the tower. The "Thermohm" was polished and thinly sprayed with a colloidal suspension; the housing was repainted. It was also found that innumerable insects had been drawn up into the interstices of the housings, thus modifying the flow. A recurrence of this situation was avoided by covering the intake with wire screen.

The results of the tests which followed this experience proved encouraging. In each of the five basic tests, one housing (the test unit) was subjected to changes in exposure while the sec-

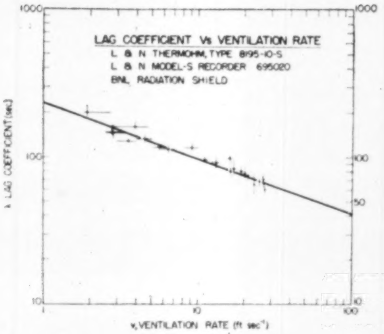


Fig. 7. Effect of ventilation rate on lag coefficient.

ond (the control unit) was left to change with natural conditions. The tests included (1) shading from the direct rays of the sun; (2) shading of the long-wave radiation from below the housing; (3) removal of the bottom disc, and exposure to long-wave radiation; (4) shielding against small-angle rays falling within the bottom disc; and (5) effect of an infrared lamp placed close to the housing. Except for the last, all were conducted under varying amounts of cloudiness and solar radiation. Wind speeds varied from 1 to 7 m./sec. The results showed no difference between the control housing and the test housing for each section of (1) through (4), and only limited indications of heat transmission with the lamp at lower wind speeds. Thus the housing in use at Brookhaven is an effective radiation shield.

Calibration and Maintenance

Equipment intended to give a high degree of accuracy should have rigorous routine calibrations; this is a laborious task on a 420-ft. tower. Initially, calibrations were conducted on cloudy days, when the departures from a mean temperature were relatively small. On such occasions a mercurial thermometer was inserted in the base of a housing. An observer read the temperature, while another man checked the printed "Micromax" record. There were many deficiencies in this method. The foremost among these was related to the variability of air temperature.

A superior technique is now in use. The "Thermohm" and housing, non-aspirated of course, are immersed in a bucket of water (Fig. 8). The water is circulated within the inner radiation shield and around the "Thermohm" by a miniature pump. Water is drawn into the pump and forced through a tube which leads to the base of the housing. It is difficult to obtain a steady water temperature if a differential exists between air and water. Thus warm water and/or ice are used to bring the bath temperature to within 0.1 C. of the air. It is most desirable to conduct a calibration on the tower at night, under cloudy skies, with a light to moderate wind; at such a time the air-temperature fluctuations are a minimum. Readings are made each half minute for five minutes with one of several 76-mm. immersion thermometers calibrated by the Bureau of Standards. The thermometers are read to 0.01 C. Simultaneously, a record is obtained of the "Thermohm" response on its associated recorder. Differences are tabulated; then, the proper compensation is introduced in the circuit so that the error is within 0.05 C.

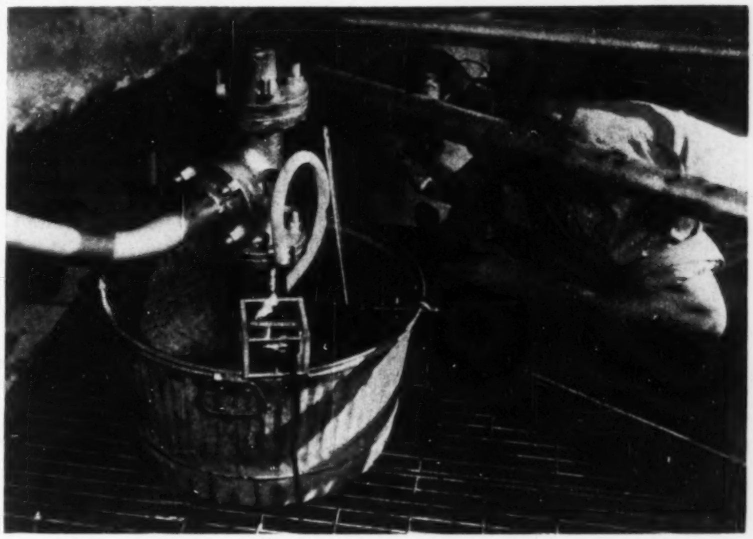


Fig. 8. Calibration technique.

Calibrations are normally conducted every two or three months, depending on the weather. A small amount of unaccountable drift is the rule. The drift error between calibrations averaged over the years 1951 and 1952 amounts to 0.06 C. for the "Model-S" system, and 0.12 C. for the "Model-R's." Routine maintenance schedules covering lubrication and cleaning follow those recommended by the manufacturer.

Lightning

Ace tower has sustained several strikes. Damage included burned-out "Thermohms" and inoperative recorders; lack of shielded cables from the booms to the building contributed to the damage. Dr. K. B. McEachron of General Electric's High Voltage Laboratory recommended that a measure of protection could be achieved by (1) grounding the common leg of each three-lead "Thermohm"; (2) using 5-mfd. capacitors across the resistance leads, and (3) fusing the recorders wherever possible. These measures, with others, have proven profitable for the 12-point "Micromax" instrument and its associated "Thermohms." It was found impossible to maintain accuracy with the "Model-R's" if grounding of any sort was attempted; this is a characteristic of the temperature-difference circuit, not of the recorder. The problem of "Thermohm" protection on a high tower deserves more attention.

Acknowledgments

The authors wish to acknowledge the encouragement and helpful criticism of Maynard Smith. Fred Bartlett and Robert Brown assisted with the lag-coefficient tests; Herman Bohnhorst aided with the reflectivity tests; Gilbert Raynor performed many of the tests related to the radiation shields. Appreciation is expressed to D. Robertson of the Leeds and Northrup Company, and to R. Wanta of the U. S. Weather Bureau for review and suggestions. We are indebted to Philip Lowry, now with Operations Research, John Hopkins University, for guidance and encouragement.

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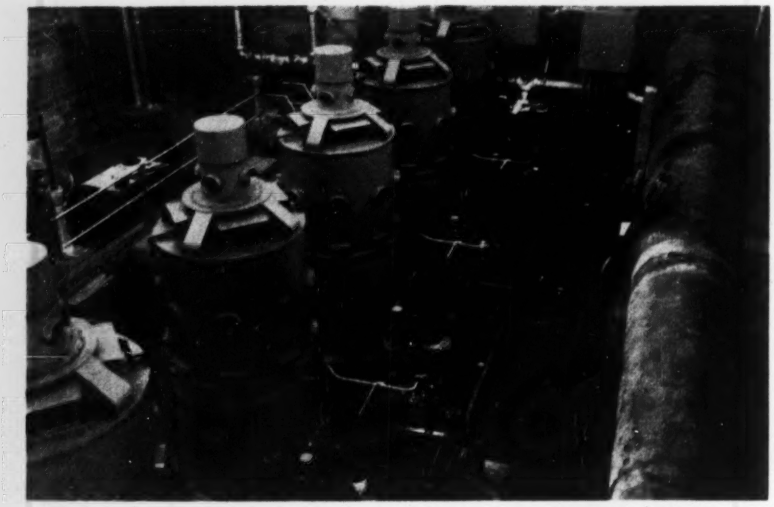

Fig. 1. Interior of pump room, showing pump motors, discharge pipes, and headers.

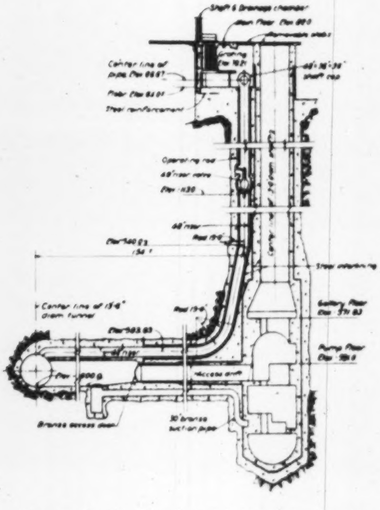

Fig. 2. Vertical section of Shaft 6, showing 48-inch riser to which the discharge conduit from the pumping station connects.

PUMPING-PLANT CONTROL

Control of the Hudson River Emergency Pumping Plant involves control of (1) tunnel pressure, (2) 36-inch cone valves in the drainage chamber, (3) 24-inch gate valves in the pump discharge line, and (4) oil and air pressure in accumulator tanks. Also described are emergency shut-down facilities.

by TORRIS EIDE
N. Y. Board of Water Supply

HUDSON river pumping plant (Fig. 1) is on the east bank of the Hudson river near Chelsea, New York. It is designed to pump water from the river into the Rondout-West Branch tunnel of the Delaware aqueduct, which lies about 600 feet below the river. At the Shaft-6 drainage chamber of the aqueduct (Fig. 2), located about 750 feet east of the pumping plant and 65 feet higher, a concrete-lined steel riser pipe, 48-inches in diameter, connects the tunnel with the chamber. It terminates in a bronze shaft cap or tee having two 36-inch outlets closed by bronze gate valves, to one of which is connected a blow-off line with a 36-inch turbine-operated gate valve. This riser afforded a ready means of pumping water into the Delaware aqueduct. The pumping plant and the riser are connected by a 54-inch steel discharge conduit.

The installation (Fig. 1) consists of six vertical pumps, one a spare, of the deep-well type, with five stages, each pump having a capacity of 20 mgd. under a head of 600 feet. The pumps are driven by synchronous motors, each rated at 2500 hp. and operating at 900 rpm. on 3-phase, sixty-cycle 4,160-volt current.

The connection between each pump and the discharge header contains a 20-inch Chapman *cone check valve*, a tee with a branch containing a 10-inch *gate valve*, and a *Pelton surge suppressor* (Fig. 3) and 24-inch motor-operated *gate valve* next to the discharge header. At the drainage chamber the 54-inch discharge conduit divides into two 36-inch branches, one connecting directly to the shaft cap and the other looping around and connecting to a tee inserted in the blow-off line.

Each branch contains a 36-inch Chapman cone valve and a 16-inch line from the first branch, connecting with an existing stilling chamber which contains a gate valve and a Pelton pressure-relief valve. The function of the cone valves is to close the connection to the tunnel in event of a serious rupture of the discharge conduit; the function of the relief valve is to prevent an excessive pressure rise in the shaft cap on the closing of the cone valves.

The starting and stopping of any pump in normal operation is manual. Protective controls, automatic and manual, insure that the proper conditions are established and proper sequences followed in starting and stopping, and also limit rises in pressure that might otherwise rupture the discharge conduit and header.

The bronze gate valves on the shaft cap and the 36-inch valve in the blow-off line can be operated only from the drainage chamber and are not interlocked with the pumping plant. Since the plant was put in operation the bronze valves have been left open and the blow-off valve closed.

Starting Pumps

The following conditions, controlled by electric interlocks, must be fulfilled before any pump can be started. (1) The 54-inch discharge conduit must be full and under tunnel pressure. (2) The two 36-inch cone valves in the drainage chamber must be open. (3) The 24-inch gate valve in the pump discharge line must be open. (4) The oil level and air pressure in the accumulator tank for the 20-inch cone valves in the pump room must be at the proper level.

Condition 1—Discharge Conduit

A 5-inch pipe line connecting with the shaft cap is provided for filling the discharge conduit, the valve being operated manually. A pressure switch connected to the discharge header in the pump room provides the control for the first condition.

Condition 2—Cone-valve Control

The 36-inch cone valves are hydraulically (oil) operated. They are arranged for closing either by pitometer or push

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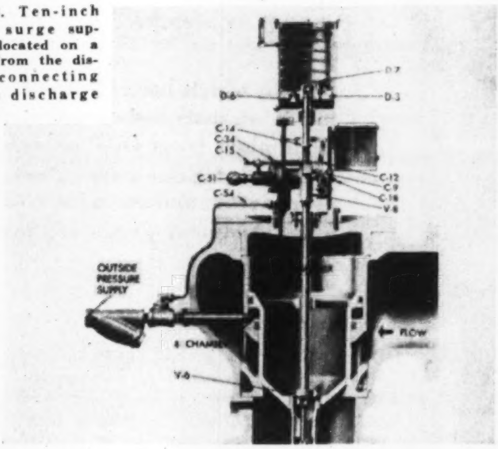
Presented at Conference on Instrumentation in Water, Sewage and Industrial Waste Treatment, May 14, 1953, Manhattan College, N. Y.

Fig. 3. Ten-inch Pelton surge suppressor located on a branch from the discharge connecting pump to discharge header.



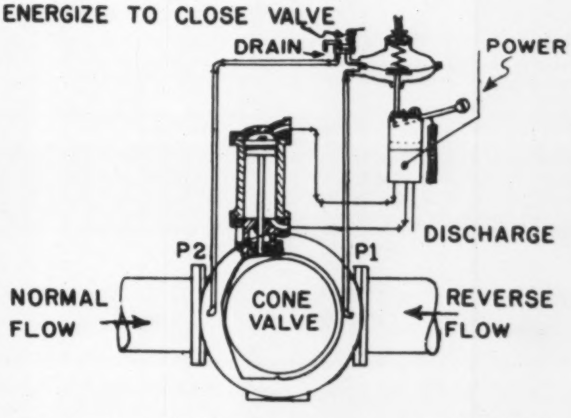


Fig. 4. Control of the 36-inch cone check valves, which are located in the branch pipes connecting the 54-inch conduit to the shaft cap at Shaft 6.

button, and for manual opening (Fig. 4). The oil system consists of an accumulator tank and an oil pump and air compressor for maintaining the oil level and air pressure in the accumulator at the proper levels, their motors being started and stopped by Mercoid float and pressure switches. Control valves keep the cone valves open except when a flow in the reverse direction (from the tunnel) exceeds a velocity of 10 fps., in which event the valves close.

The positioning of this control valve for opening or closing the cone valve is done by means of a spring-loaded diaphragm to which the legs of a pitometer are connected. The diaphragm controls a latch that holds the control valve in the open position for normal flow. For reverse flow the pitometer forces exceed the force of the spring, causing the latch to be released and the control valve to close. The cone valve closes in 15 seconds. A push button adjacent to the valves and one in the pump room will also cause the cone valves to close in the same time. The closing of these valves (by push button or by reverse flow exceeding 10 fps.) will cause all the surge suppressors to open, the 20-inch cone valves to close in 7 seconds, and stop the pumps.

Loss of pressure or drop in oil level in the accumulator tank during pumping will set off a warning siren.

Having started the motors of the oil pump and compressor and brought the oil and air pressure in the accumulator tank to the proper levels, the 36-inch cone valves may be opened, one at a time, by a small hand valve on the oil line to each valve, thus establishing condition (2). This is the only means of opening these valves and was adopted to prevent accidental opening.

Condition 3—Gate-valve Control

The 24-inch motor-operated gate valve in the discharge line of each pump is controlled by a push button. When fully open a limit switch releases an interlock, thus establishing condition 3.

The operation and control of the 20-inch cone valves are similar to that of the 36-inch valves except that after the proper level of oil and air pressure has been established *as required by condition* 4, the opening and closing of these valves are automatic.

Having established the four conditions the operator may start any pump by pressing the push button of the starter. The pump comes up to synchronous speed in a few seconds and the 20-inch cone valve starts opening automatically, requiring 2 minutes to open fully. For a normal stop, the stop button is pressed and the valve closes in 2 minutes; a limit switch stops the motor after the valve has closed.

An emergency stop button, provided for each pump, can cause the 20-inch cone valve to close in 7 seconds and the surge suppressor to open and stop the pump motor.

Emergency Shut-down

In an emergency shut-down the controls function as follows: (1) *For power failure*, all surge suppressors will open in one second, all cone valves close in seven seconds, and all pump motors stop. (2) *For loss of control voltage*, the surge suppressor and cone valve on the affected circuit will function and stop the pump motor. (3) *For mechanical or electric failure of pump motor or starting equipment*, all surge suppressors will open if the line pressure drops below the setting of the pressure switch (157 psi.), all cone valves will close, and the pump motors will stop.

Pelton Surge Suppressor

The 10-inch Pelton surge suppressor (Fig. 3) is an angle-type valve of importance in the functioning of the plant. Inside the body is a cylindrical plunger guide within which a hollow plunger moves up and down to open and close the valve. The plunger and guide form the A chamber to which pressure is admitted to close the valve; the space between the guide and plunger below the top of the plunger forms the B chamber to which pressure is admitted to open the valve, the pressure in the A chamber being released by a drain. A solenoid, C-53, is energized when electric power and line pressure are normal and holds the controls so as to permit no valve movement. On de-energizing the solenoid, control lever C-12, pivoting about pin C-55, held by latch C-9, is moved to the left by spring C-34, resulting in movement of control valve C-4 to the right, and opening A chamber to a drain. This permits the pressure in the B chamber to move the plunger and open the valve in about one second. As the plunger nears full opening, collar C-8 causes latch C-9 to be raised, and permits spring C-34 to close the control valve C-4, and so stop further exhaust from the A chamber. Line pressure now entering the A chamber through C-54 acts to close the surge suppressor. The closing movement of the plunger is controlled by pilot valve C-5 and the operation of the dash pot, and takes not less than 15 seconds. A pilot relief valve, C-51, is set to open whenever the pressure in the discharge conduit exceeds 700 feet. Line pressure then moves piston C-5 to the right and opens the A chamber to drain, thus causing the plunger to open. A hydro-pneumatic accumulator on the pressure line to B chamber maintains a pressure of 100 psi., sufficient to open the surge suppressor quickly even though an abnormal decrease in pressure occurs in the discharge conduit following an emergency shut down.

The 16-inch Pelton relief valve in the drainage chamber is also an angle valve, similar to the surge suppressors, but the controls are somewhat different. Tunnel pressure, admitted to the A chamber by a pressure supply line, holds the valve in the closed position. Excess pressure in the tunnel (above a head of 650 feet, or 280 psi.) opens a diaphragm-type spring-loaded pilot relief valve on the pressure line, allowing the A chamber to drain; the increased tunnel pressure, admitted directly to the B chamber through a port, opens the valve rapidly. With the tunnel pressure reduced to normal the pilot relief valve closes, admitting full tunnel pressure to the A chamber; the valve then closes in 15 seconds. An indicator lamp in the pump room, connected to a limit switch on the valve, is lighted while the valve is closed.

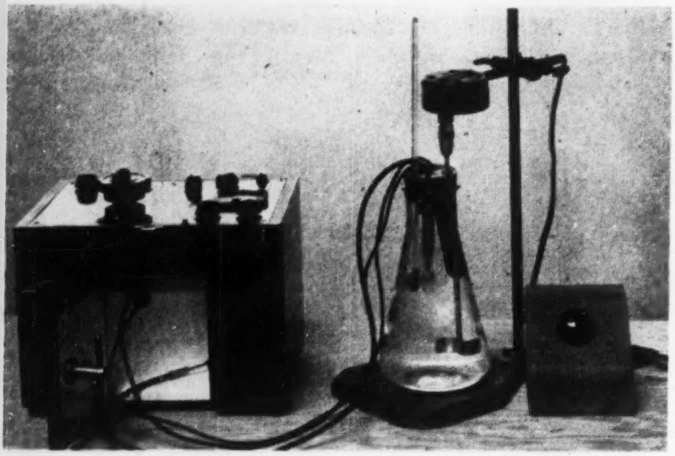


Fig. 1. Field instruments used for ORP studies.

Rate at which bacteria are metabolizing in an activated-sludge system can be implied from ORP measurements in a sealed Erlenmeyer flask. Instrumentation and results from three waste-treatment plants are presented.

Measurement of Oxygen Uptake by Oxidation-Reduction Potential

By JOHN P. HORTON
National Dairy Research Laboratories, Inc.

IN the activated-sludge process the rate at which waste products are stabilized depends in part on the degree of bacterial activity of the organisms in the aeration tank. Some of the factors affecting the degree of bacterial activity include (1) kinds and numbers of organisms present, (2) condition of the individual organism, (3) growth phase of the mass, and (4) nature of the various waste contituents and their quantities. These factors also affect the oxidation-reduction potential (ORP) and, therefore, it should be possible to determine the condition of an activated-sludge unit by studying ORP changes.

The thinking behind the use of ORP to determine the activity of organisms in the activated-sludge process is an extension of the well-established concepts regarding the biochemical changes occurring in a biological system. In an isolated biological culture to which no oxygen or other oxidant can be added, the ORP decreases as the organisms metabolize and oxidize the food material. In other words, the system becomes more reducing.

The more rapidly bacteria or any microorganisms utilize and oxidize food materials, the more rapidly does the ORP of a closed system change. Therefore, the time rate of change of ORP should be related to the rate at which bacteria are working and oxygen is being utilized—provided that no new oxidants are being added to the system.

When the biological system is aerobic—that is, when dissolved oxygen is present initially—the rate at which the ORP decreases is an indication of the rate of oxygen utilization because dissolved oxygen, being the most readily available oxidant, is utilized first. As oxidation or reduction is, in the broad sense, an electron transfer process, dissolved oxygen need not be present for oxidation to take place. Inasmuch as ORP, as the name implies, is an electrical potential indicating the tendency for the transfer of electrons, ORP measurement applies to the broad concept of electron transfer.

Purification of sewage and waste in a biological system involves an enzymatically catalyzed series of oxidation-reduction reactions. In waste-disposal systems the oxidant is usually dissolved oxygen, but other oxidants such as chlorine,

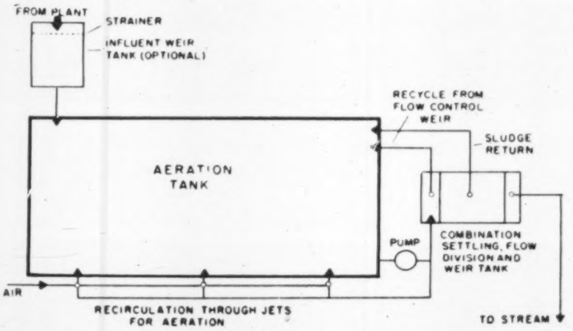

FROM PLANT
STRAINER
INFLUENT WEIR TANK (OPTIONAL)
RECYCLE FROM FLOW CONTROL WEIR
SLUDGE RETURN
AERATION TANK
COMBINATION SETTLING, FLOW DIVISION AND WEIR TANK
PUMP
AIR
RECIRCULATION THROUGH JETS FOR AERATION
TO STREAM

Fig. 2. Basic flow sheet for small dairy waste-treatment plants of the activated-sludge type.

Presented at Conference on Instrumentation In Water, Sewage and Industrial Waste Treatment, May 14, 1953, Manhattan College, N. Y.

nitrates, sulphates and some organic sources of oxygen do exist. Eckenfelder has converted the basic ORP equation

$$E_h = E_o + (RT/nF)\ \ln\ (\text{Oxidants/Reductants})$$

into the approximation

$$E_h = E_o + \ln\ (\text{D.O./BOD})$$

where E_h is the oxidation-reduction potential and E_o is a system constant. If the ORP is affected by both dissolved oxygen and BOD, the time rate of change of ORP is related to the time rate of change of D.O. (dissolved oxygen) and BOD (biological oxygen demand).

In the basic equation, R is the universal gas constant in volt coulombs, T is absolute temperature in degrees K., n is number of moles in system, and F is Faraday's constant.

Instrumentation

Instruments to study ORP change in a closed system may be built with ease. Fig. 1 shows the equipment which was used for the field studies reported below at three dairy waste-disposal plants of the activated-sludge type. The heart of the unit is the Erlenmeyer flask in the center.

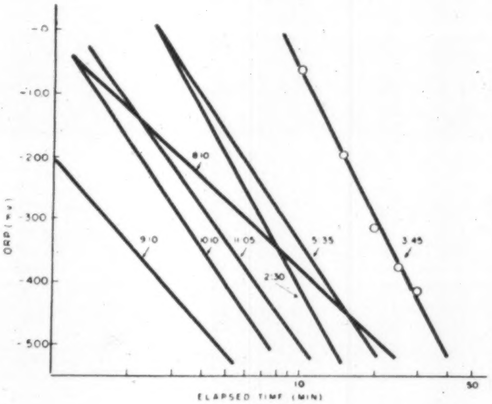


Fig. 3. ORP of mixed liquor (from the aeration tank at a small dairy waste-treatment plant) plotted against natural logarithm of time.

The flask is sealed with a rubber stopper in which are mounted a thermometer, a glass pH electrode, a calomel reference electrode, and a platinum electrode for ORP. A small laboratory stirrer, rheostat-controlled, is used to agitate the contents of the flask. Where the propeller shaft passes through the rubber stopper, an oil seal is used to exclude air. The leads from the three electrodes are connected to a Beckman "Model G" potentiometer to measure pH and ORP. The equipment is mounted in carrying cases. The only requirement for field operation is a source of electricity for the stirrer.

In field use, mixed liquor from the aeration tank is placed in the Erlenmeyer flask. The flask is stoppered to exclude all air bubbles; no air enters the system once the stopper is in place and the oil seal has been formed. Thereafter, with the stirrer running, the ORP changes are observed with time and recorded. Temperature and pH determinations are recorded at intervals as controls. The time necessary to complete the test and the frequency of making observations depend on the amount of bacterial activity in the mixed liquor, and vary from plant to plant. Major pH variations affect the ORP to some extent and their presence must be determined.

This technique was used in studies of the activated-sludge system at three dairy waste-treatment plants. The basic design of these treatment plants is shown in Fig. 2. When the ORP is plotted against the natural logarithm of the elapsed time, a straight line is obtained (Fig. 3). If the *time rate of change* of ORP (the slope of the curves) is plotted against the time of day at which the samples were taken, curves as in Fig. 4 are obtained.

The waste load first enters the waste-treatment plant about 7 o'clock in the morning and stops shortly after noon; the rest of the day is required for the stabilization of the waste load that entered the plant in that period.

The lower curve (N) of the Fig. 4 was obtained at the treatment plant in which there was approximately 120 hours retention in the aeration tank. The curve indicates that the effect of the raw waste load, which at this plant is not very strong, is negligible, and that the metabolic activity in the tank is relatively constant throughout the day. The curve also indicates that the rate of stabilization is low, as is expected in such a situation.

The upper curve (S) was obtained from a treatment plant which was supplied with only ½ cfm. per lb. BOD per day, and in which the degree of stabilization as indicated by the effluent BOD was not as good as that at the other two plants. The curve shows that the degree of metabolic activity, which was at a high level when the waste load first entered the treatment plant, increased rapidly during the morning, reached a peak around 3 o'clock, and then dropped off. The fact that the effluent from this plant, although meeting state requirements, was not fully stabilized is reflected in the high rate of activity persisting even before the daily waste load entered the plant.

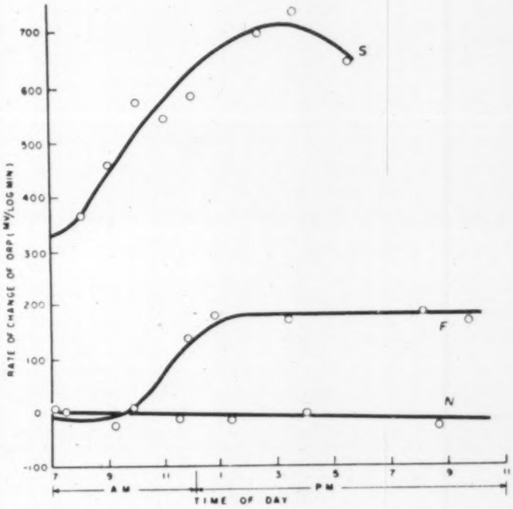


Fig. 4. Hourly variations in metabolic activity of activated sludge at three small dairy waste-disposal plants (rate of change of ORP vs. time).

The middle curve (F) represents perhaps the ideal operation. At the beginning of the operating day there was little bacterial activity. As the waste load built up in the aeration tank the activity increased, reaching a higher level around 1 in the afternoon. This level persisted throughout the day, not decreasing until after 10 PM. By morning the tank contents were highly stabilized, as confirmed by a low effluent BOD, and the treatment plant was in condition to receive the next day's load.

The first part of the curve shows a negative rate of change of ORP. This means that the ORP of the mixed liquor in the Erlenmeyer flask increased. The significance of this is not yet understood.

In conclusion, a theoretically sound control procedure for field use has been developed. Results at three waste-disposal plants of the activated-sludge type have been described. Two might be described as limiting conditions—one in which there was excessive retention and aeration per lb. of BOD in the aeration tank, and one in which there was low aeration per lb. BOD and incomplete stabilization. The third, intermediate between the first two, represented an optimum operating situation.

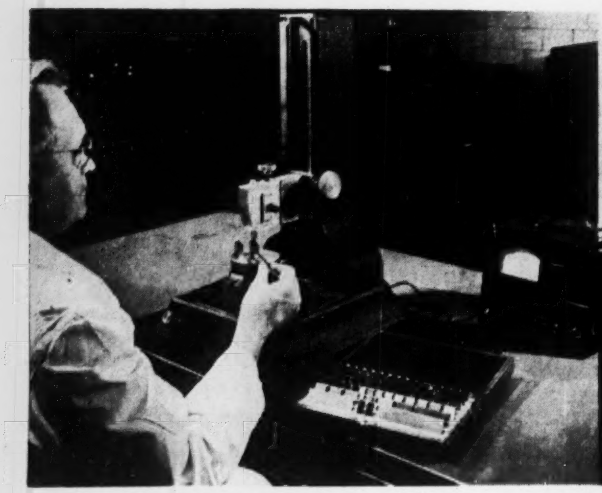


Fig. 1. Pratt and Whitney "ElectroLimit" comparator checks diameters, roundness, bell mouth, straightness, etc.

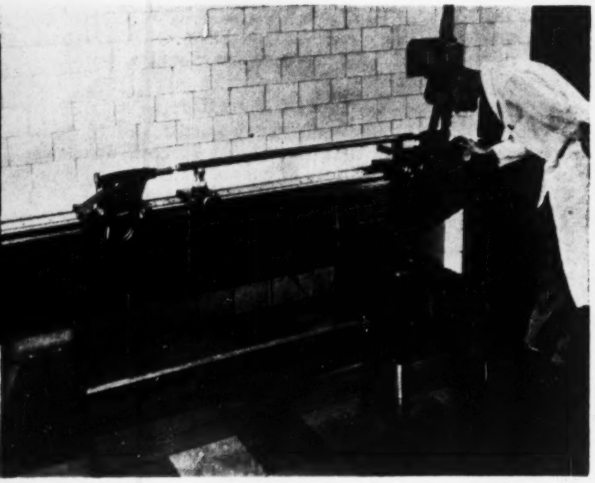


Fig. 2. Carl Zeiss 80-inch measuring machine measures length and diameter.

Tool and Gage Inspection

The general foreman of a large tool-inspection department reports on the instruments, personnel, and functions of his department.

By MICHAEL C. CURTIS
Timken Roller Bearing Co.

Modern standards of length are controlled by a platinum iridium bar on which two lines are scribed one meter apart. This bar, adopted by the United States in 1866, was used to establish the value of light interference bands, which are the basis for measuring throughout the world. In 1896, the first set of Johannson gage blocks were produced in Sweden. Today, gage blocks, measured by the light interference method, are the practical standard which enables the interchanging of parts throughout the world.

The Tool Inspection Department of the Timken Roller Bearing Company is responsible for the accuracy of the thousands of tools and gages and for many of the machine parts necessary in the manufacture of Timken Tapered Roller Bearings. This department at the Canton factory inspects all master and high-precision gages for every company plant in the United States and Canada. The department is comprised of tool inspectors, checkers and crib attendants, gage and instrument repairmen, hand lappers, apprentices, and supervisors.

At present, we have about 80 sets of gage blocks throughout the Canton plant. These sets, comprised of eighty-one different measuring blocks, enable our men to measure any size in steps of one ten-thousandths of an inch.

At present, The Timken Roller Bearing Company is replacing many mechanical gages with pneumatic or air gages. Air gaging has many advantages—(1) it does not distort due to low gaging pressure, (2) it does not scratch highly finished parts, (3) the cost of up-keep of master gages is reduced considerably.

Production of the Timken "Double-Zero" bearings, which are guaranteed to run true within seventy-five millionths of an inch, is made possible only by use of gages made to a tolerance of ten-millionths of an inch. The exactness of the work may be better realized when you consider that a millionth of an inch is 3,000 times finer than a human hair. At the present time, a prominent American scientist is developing a system to measure in billionths of an inch.

As changes in temperature affect high-precision measurement, a constant temperature of sixth-eight degrees Fahrenheit, and a relative humidity of forty percent are maintained in our laboratory. The laboratory, covering 2500 square feet of room space, is equipped with a dust control unit and is well lighted. Precision gages not in use are stored in glass cupboards.

Gaging Instruments

(1) A hardened ground and lapped "Graph-Mo" *steel surface plate*, for measuring flatness, is thirty-six inches wide and sixty inches long. It is flat within fifty millionths of an inch. We believe that this precise plate is the only one of its kind in use.

(2) A Bausch and Lomb *universal measuring projector* is used as a measuring machine or as a comparator. Work, compared to a scale size chart, is accurate within one ten-thousandths of an inch for linear measurements and 1 minute for angle measurements.

(3) A Pratt and Whitney "ElectroLimit" *comparator* (Fig. 1) is used in our department for checking internal diameters and can be used for checking external work. Roundness, straightness, bell mouth, and size can be determined. The gage is graduated in twenty millionths of an inch and an estimation of five millionths of an inch can be made. This is a comparator gage.

(4) A Carl Zeiss 80-inch *measuring machine* is used to measure lengths and diameters from 0 to 80 inches. It is accurate to 0.000020 inch per inch of length. Its function

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Presented at the 1953 Conference on Instrumentation for the Iron & Steel Industry, Pittsburgh, Pa.

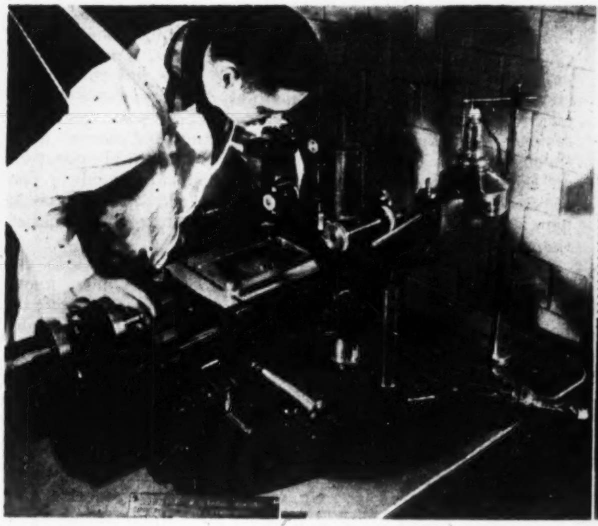


Fig. 3. Zeiss universal measuring microscope for linear and angular measurements.

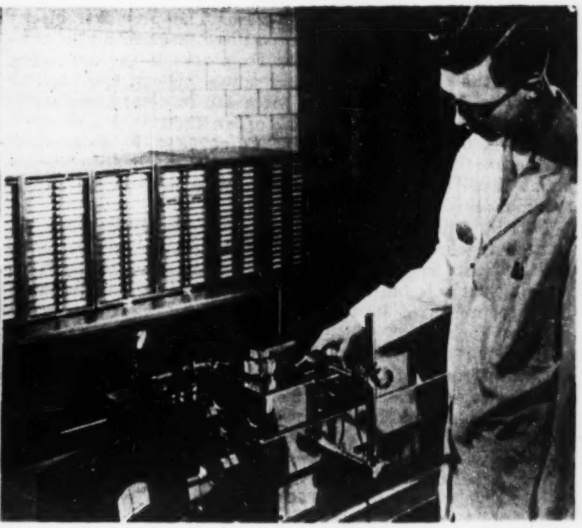


Fig. 4. Brush analyzer unit determines surface finish.

is that of the Universal Linear Measuring Machine. The work is placed between two contact points and a reading taken through the microscopes (Fig. 2). Precision gage blocks are built up to the exact size and the machine is adjusted to zero with the precision block. A piece being checked is then compared.

(5) We use a GSIP *universal measuring machine* for many measuring operations. Manufactured in Switzerland, it is graduated in five one-hundred-thousandths of an inch. This is a three-dimensional machine and measures length, width, and depth. Pitch diameter, bell mouth, and taper can be measured on internal threads.

(6) Another universal measuring machine we employ is the Zeiss *universal measuring microscope* (Fig. 3). Many different types of measurements can be made on this gage. It is graduated in five one-hundred-thousandths of an inch in linear measurements and one minute for angle measurements. Most of the time it has been used 24 hours a day. It still retains extreme accuracy after 25 years of use.

(7) We use a Brush *analyzer unit* (Fig. 4) to determine surface finish. Surface finish can be determined visually on graph paper or the RMS. can be taken from the meter.

(8) A *sine bar* in our laboratory is used to compare taper with a reference master of known taper. The comparison between the reference master of known taper and the work master can be estimated within five millionths.

(9) Another fixture in constant use compares roller work masters with a reference master of known size and taper. This was developed with a device used for seating both the reference size and taper masters with the work size and taper master in a tapered ring gage.

(10) We use a Vinco *dividing head* to check regular angular locations of holes and for checking cams and irregular-shaped pieces. It is graduated in one second of arc.

(11) A special fixture compares an imaginary sharp-corner diameter of a tapered piece at the intersection of the taper and the face. The size between two wires of a known size is calculated. The precision gage blocks are built to the calculated size. The blocks are placed between the wires

Fig. 5. Optical flat and monochromatic light for checking flatness.

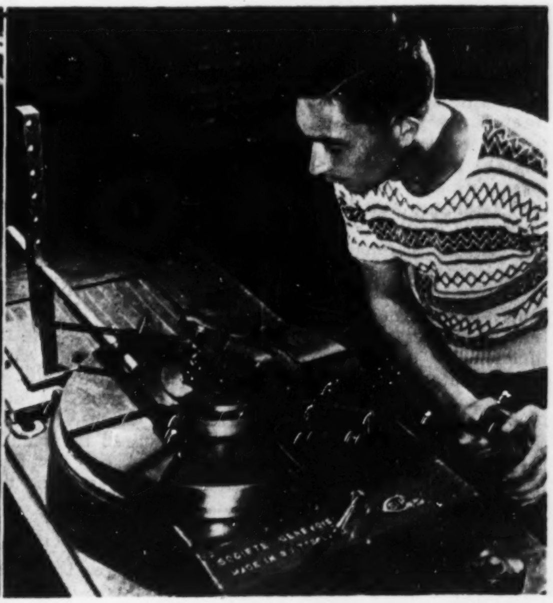


Fig. 6. GSIP circular dividing table checks location of holes, angular measurements, etc.

and the optimeter tube set to zero. The precision blocks are then removed and the tapered piece inserted and a comparison is made. Any deviation from zero is the difference between the calculated size and actual size of the tapered piece. The size of the tapered piece can be determined within about twenty-five millionths of an inch.

(12) A 6-inch-diameter *optical flat* (Fig. 5) determines the degree of flatness on flat work within an accuracy of about three or four millionths of an inch with the aid of the monochromatic light.

(13) A GSIP precision *circular dividing table* (Fig. 6) is used to check location of holes, angular measurements, rise and fall of cams, and other universal checking. This dividing table is built by the Societe Genevoise in Switzerland (represented in the U. S. by the Cosa Corporation of New York).

(14) We designed and built a high-precision center to determine runout in the accuracy of ten millionths or under.

(15) Gage blocks are checked by the electronic comparator, which compares the precision gage blocks with the laboratory set of blocks. This gage is graduated in 0.000001 inch.

Personnel

The *tool inspectors* inspect tools, gages, and machine parts for size, visible surface finish, and material defects and also assist tool makers with their more complex problems. *Tool checkers* do similar work of less extreme accuracy. *Tool-crib attendants* issue tools, gages, and machine parts to the operating departments; care for the equipment; maintain an adequate supply; and prepare equipment for use. *Gage and instrument repairmen* repair the several thousand dial-type gages and indicators used throughout the factory. *Hand lappers* do the final operation on the more precise parts that cannot be ground to the required accuracy. *Apprentices* are trained in the various departments. Supervisors instruct the workers and assist them in their activities.

One cannot say exactly how many years it takes to develop a good tool inspector. A tool inspector must know how to operate all the high-precision gaging instruments, how to recognize material defects, and how to judge surface finish. Some knowledge of mathematics, gears, threads, and cams is required. A tool inspector must know where and how the many parts are used, plus what is required of each part. He must know how to make ingenious arrangements to obtain information regarding size and shape and to determine whether or not the part meets blueprint specifications. He must work with the fact that steel is resilient, and that it sags of its own weight and changes size and shape with temperature. A good tool inspector never stops learning.

ORDNANCE INSPECTION

Contractors supplying ordnance material should be familiar with inspection requirements, particularly the functions of the Resident Inspector, the preparation of the Inspection Plan, the prescribed inspection procedure, and the inspection requirements of the contractor. The new unified inspection plan of the Department of Defense is described.

by MAJOR W. M. MATEER
Pittsburgh Ordnance District

THE Ordnance Corps assists the Resident Inspector in performing his mission, which is to design, procure, inspect, accept, ship, proof test, store, issue, maintain and recover all items of Ordnance materiel. The organization of the Ordnance Corps (inspection-wise) is as follows:

1. *Office, Chief of Ordnance (OCO)*: Formulates general policies and procedures of inspection as they pertain to the lower levels of command. Supervises the program.
2. *Industrial Division, OCO*: Carries out the responsibilities. This division has several branches—artillery branch, ammunition branch, small-arms branch, and automotive branch.
3. *Procurement Centers*: Under the Industrial Division are the four Procurement Centers for specific items. These are: (a) Ordnance Ammunition Center, Joliet, Illinois, (b) Ordnance Small Arms Center, St. Louis, Missouri, (c) Ordnance Tank Automotive Center, Detroit, Michigan, and (d) Ordnance Small Arms Center, Springfield Armory.
4. *Mission Arsenals*: Also under the Industrial Division are the eight Mission Arsenals, which (a) perform research and development work on new items, (b) do the original manufacturing, usually experimental, or also regular production-line manufacturing, (c) provide technical assistance to other Ordnance installations and contractors, and write technical manuals for the guidance of the using troops, (d) establish specific training programs, (e) write specifications, (f) produce drawings required to manufacture, inspect and gage specific items, and (g) write and distribute the Standard Inspection Procedures to be used by the Ordnance Corps.
5. *Proving Grounds*: Proof fire and accept items for Ordnance. These are Aberdeen Proving Ground, Aberdeen, Maryland; Erie Proving Ground, La Carve, Ohio; and Jefferson Proving Ground, Madison, Indiana.
6. *Loading Plants*: Store metal parts from various contractors, load and assemble the various items, and store some finished rounds.
7. *Ordnance Districts*: The fourteen Ordnance District Offices are close to the industrial centers of the country. They procure the various items of Ordnance as requested by the Procuring Centers. Each District has an Inspection Division with the following Branches: ammunition inspection branch, artillery and small arms inspection branch, tank-automotive inspection branch, gage branch, inspection service branch, and resident inspectors.

The Gage Branch is responsible for acceptance and issuance of gages and measuring equipment. It establishes a surveillance period, checks all gages within the prescribed period, and assures control on the wear of gages.

The Resident Inspector

The *Resident Inspector* of Ordnance is the Government representative at the facility. He is the Ordnance employee with which you are most familiar. He has direct responsibility to inspect, accept, and ship the items of Ordnance which you produce.

The tools and inspection requirements of the Resident Inspectors are:

1. *The Contract*: The main and controlling instrument used by the Resident Inspector for inspecting and accepting the item. Any requirement in conflict with the contract is superseded by it.
2. *Drawings*: Second in the line of inspection requirements.
3. *Special Specifications*: Written by the Mission Arsenal, these deal with a specific item.
4. *General Specifications*: Written by the Mission Arsenal, these are of a general nature and pertain to a specified class of items or a basic raw material.

Presented at the 1953 Conference on Instrumentation for the Iron & Steel Industry, Pittsburgh, Pa.

5. *Inspection Handbooks and Manuals*: The basic guides of the Inspector, these delineate the methods that the Resident Inspector uses and outlines his general duties and obligations.

6. *District Policies and Regulations*: The local ground rules which govern the inspection operation within the Ordnance District.

7. *Inspection Plans and Procedures*: Outlines to the Inspector the detailed specifications required to inspect the item at his facility.

The Inspection Plan

The Inspection Plan (1) provides uniform inspection of a specific item throughout all Ordnance establishments, (2) removes from the Inspector the direct responsibility of setting up an inspection system within a specific plant, and (3) provides supervisor with check on Inspector's mission.

The Inspection Plan consists of (a) *The Prescribed Inspection Procedure*, which outlines all the inspection requirements and the methods for carrying them out, (b) *The Contractors Plan of Production and Inspection*, which delineates in detail the production operation, the inspection stations of the contractor, and the method by which he will inspect; this includes a plant layout with the various inspection stations marked, (c) *The Organization of Ordnance Inspection*, which shows where the Ordnance Inspection stations will be, and the method of inspection that will be employed at each station, (d) *Projection of Ordnance Requirements*, which projects the personnel and gage requirements for Ordnance personnel as may be required in the future as the contract production increases to full capacity, (e) *Plan of Ordnance Personnel*, which sets forth the Ordnance personnel to be stationed at the facility and delineates lines of authority, (f) *Job Description Data*, which outlines the basic job description data and the established grades for each job, and (g) *Manning Table*, which is used for further projections as the production under contract increases or decreases.

After the plan has been written (in the District Office) it is closely checked; ten concurrences must be obtained by various District personnel prior to its being issued. Prior to, or during, the writing of the Inspection Plan, a meeting is arranged with the contractor, key personnel of the Ordnance District Office, and the Resident Inspector. All phases of inspection and production are discussed and the methods of inspection to be used by both Ordnance and contractor are determined.

Prescribed Inspection Procedure

The Prescribed Inspection Procedure covers all phases of inspection pertaining to the item under production. It sets forth the nomenclature of the item; lists all the drawings and specifications; and lists the Government final inspection gages available. Where such gages are not available, it lists the contractor's gages to be certified or used in lieu of such gages.

Certifying a Contractor's Gage

If the contractor's gage is manufactured from an Ordnance drawing, it may be *certified for use* by the Inspector. If the gage is made under some drawing other than Ordnance, but the gage accepts acceptable material and rejects rejectable material, it may be *approved for use* by the Resident Inspector. The Inspector may use only certified or approved gages. It is also possible for a contractor to have an Ordnance Gage Laboratory run a *courtesy check* on his gages to determine that they are within the tolerances of drawings.

The Inspection Procedure also contains a list of all standard measuring instruments required. If Government Gages or contractor's gages are not available, this procedure will outline the standard measuring equipment to be used in lieu of the gages.

The Inspection Procedure also tells whether or not certification may be accepted on chemical requirements. If certification may be accepted, and the Resident Inspector deems it advisable, he may request the Contracting Officer to permit the use of such certification.

Inspection Requirements of Contractor

The contractor should maintain an adequate inspection system. Note that the burden of inspection under the terms of the contract rest with the contractor because he has contracted to furnish only acceptable items; the responsibility of the Ordnance Inspector is simply to tell the contractor whether or not the items are acceptable. The contractor should also adopt some method of process control; the Ordnance District will furnish guidance and information to establish an acceptable method of process control. Good process control and adequate inspection on the part of the contractor are vital; rejected material means loss to the contractor.

Rejected material should be reprocessed within the same lot with which it was originally inspected. If it is allowed to creep into another inspection lot, it may cause rejection of an acceptable lot.

The contractor must maintain strict control over his sub-contractors. Prime contractors often have a mistaken conception of their responsibility for sub-contracted material; Ordnance inspection at source, on sub-contracted parts of material or sub-assemblies, is only a courtesy inspection, it is not binding on the Ordnance Corps. Ordnance accepts only end items and not sub-assemblies.

The Key Inspector

It sometimes is necessary to coordinate a program on a nationwide scale. This is the function of the Key Inspector, who is responsible for the over-all control of the item and for passing judgment on requested waivers or deviations. However, a Key Inspector cannot waive any requirement of any drawings, specifications, or contracts under any circumstances. Key Inspectors are not to deal directly with the contractor, but are to deal through the Contracting Officer. If you are a sub-contractor on some item that is being coordinated, do not go to the Key Inspector for waivers or deviations. The Resident Inspector at your plant is performing contract inspection under the specific orders of the District from which the Inspection Requisitions were received.

Plant Security

The Resident Inspector, under current regulations, is responsible only for the security of his own records and files, and for the security of any Government property assigned directly to him. You are responsible for the security of your plant and any Government property that might be there.

Unified Inspection

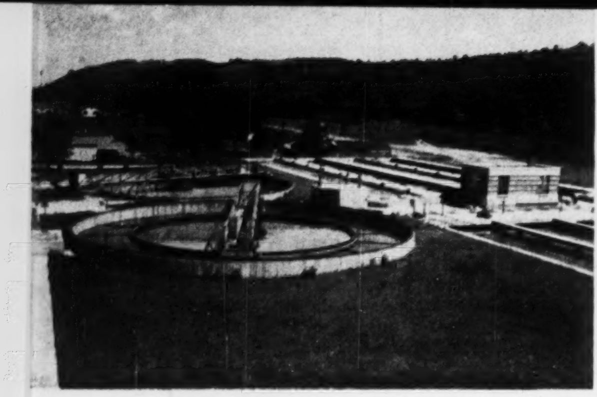
The Department of Defense is going into a program of Unified Inspection. When each service inspects its own items, we often wind up with multiple inspection in one plant, high inspection costs, and much confusion. The prime objective of the new program is to have one inspection service in any one plant which shall be responsible for the inspection of all items under contract by all services. The following procedures may be followed:

(a) The first phase is to negotiate inspection agreements between the various services about the inspection operation to be performed.

(b) The second phase of this program will be the transferring of plants from one service to the other and the transferring of the necessary files and papers.

(c) The third phase will be to notify the contractors of the various changes of inspection, and which of the Resident Inspectors currently stationed at your plant will be responsible for inspection in the future.

This program is controlled by the Defense Supply and Management Agency, which is a part of the Department of Defense, and has authority to dictate policies and procedures to all Military Departments. Under this program, the Military Departments will be able to reduce the number of personnel stationed in a plant. The duties of the Contracting Officer under this program do not change. He still is responsible for the administration of the contract and for the production phases of the contract.



Sewage Treatment Plant, Elmira, New York.

Instrument panel in a pumping station.

Instrumentation Problems in Water & Sewage Treatment

By CHARLES R. VELZY
Nussbaumer, Clarke & Velzy

SPECIAL INSTRUMENTATION PROBLEMS are found more in sewage treatment than in water supply because of the characteristics of the material to be measured and handled.

Venturi Problems

The Venturi meter was one of the first instruments used in sewage treatment, and the first application naturally used the tube developed for water use, with a piezometer ring at the upstream end and at the throat of the tube, and with piezometer piping from these rings to the pressure-differential instrument. The liquid flowing in the pipe line was the medium for transmitting the pressures.

Back flushing with clear water was used to help keep the solids out of the connections, and then sludge wells were added to trap the solids and permit them to be flushed out. Still further development has introduced air transmission of pressure and other means of eliminating all contact between the sewage or sludge and the instrument.

Trouble still was encountered in the collection of solids in the piezometer ring; finally, the ring was eliminated. This raised the question of the sacrifice of accuracy. As it is more useful to have a meter of moderate accuracy that works, than to have a precise meter which is out of operation a part of the time, it is now common practice to have one piezometer connection of relatively large diameter made directly to the upstream section and to the throat without piezometer rings.

Collection of heavy solids at the bottom of the upstream end, and the trapping of gas ahead of the throat of a Venturi tube were two more problems requiring attention. The first move was to make an eccentric tube, keeping the invert flat. This eliminated collection of solids but aggravated gas collection. Gas relief devices were not effective because they became clogged with floating solids. Late tube designs provide an elliptical throat, keeping the invert and the crown flat, thus eliminating both the collection of solids and the trapping of gas.

Overload Protection

One of the most common instrument functions in sewage treatment is protection against overload. Mechanical screens, grit-handling mechanisms, sludge collectors, and sludge pumps may be overloaded by excessive material or by objects which should not be present. A protective device and alarm is essential to prevent damage. The most common device is the *shear pin*. It is simple, but has the weakness that it often is abused when it "shears" too often. Some effort has been made to design a better overload release, and one such device has been used on the sludge collectors at the Hyperion Plant. Mr. W. A. Schneider, Waste Disposal Engineer for Los Angeles reports two years of satisfactory operation of this device.

Automatic Control

The need for automatic control may vary from one plant to another. For example, in the small pumping station the wet well is designed to provide a certain minimum pumping period so that pumps are not started and stopped too often; the pumping period may be measured in minutes. The station, being small, probably does not have constant attention. The only practical procedure is automatic operation; the instrument may be a drum controller actuated by a single float and adjusted to carry out a program of operation including all pumps in the station.

A large sewage-pumping station (say with a capacity of 100 MGD or more) presents a different picture. It probably does not have a wet well because a well of capacity to provide storage for a proper pumping period would be unreasonably large, and the storage in the sewer is more than can be provided in a wet well. Under these conditions it is usually possible to have continuous pumping with fluctuations in rate satisfied by turning additional pumps on and off. The operating period for any pump may be hours rather than minutes. As the station is large, there is an operator in constant attention. Under these circumstances the only instrument required for pump control might be a liquid-level indicator and recorder from which the operator observes the need for more or less pumps.

Another place where automatic control may be questioned is in the heating of sludge tanks. The change in temperature in a sludge tank is relatively slow—usually one degree a day or less. This can be observed easily.

Other Instrumentation Applications

Other examples of instrumentation include differential controls for mechanical screens; remote operation of sluice gates and valves; chemical feeding equipment, automatically controlled; weightometers for weighing sludge cake on belt conveyors; for incineration—recording pyrometers, draft, and vacuum gages; in gas handling equipment—pressure and vacuum relief valves, manometers, gas meters, flame traps, and condensate traps; and many others.

Presented at Conference on Instrumentation in Water, Sewage and Industrial Waste Treatment, May 14, 1953, Manhattan College, N. Y.

Journal of the S C M A . . .

SOUTHERN CALIFORNIA METER ASSOCIATION

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Techniques for increasing

Flowmeter Rangeability

Flowmeter range can be increased by proper use of (1) multiple chambers, (2) multiple meter runs, (3) differential limit controllers, (4) limiting controllers, and (5) auto-selector controllers.

by E. A. FORD
The Foxboro Company

IN past years there has been over-all acceptance of the differential type of flow measurement using the orifice plate, flow nozzle, and Venturi tube as primary elements. In the natural-gas industry the thin-plate sharp-edged concentric orifice is used almost exclusively. Although a high accuracy is obtained, such meters can be operated only within prescribed flow limits. As this factor affects all differential-type flow instruments, attempts have been made to modify and expand the limits.

One of the most demanding limitations is that of rangeability—that is, the range of measurement over which the meter can record with satisfactory accuracy. Standard practice in the gas industry is to use meters which record in units of differential pressure. However, in calculating *actual* flow, a square-root function must be introduced. Consequently, in reading a flow chart, 50 percent of flow is read at 25 percent of scale, and approximately 70 percent of the flow is read at midscale. With the size of scale per unit of measurement decreasing at the bottom of the chart, readability and accuracy are correspondingly reduced. As a result, the rangeability of a standard meter is generally regarded as about 3½ to 1; for this reason, maximum accuracy is obtained in the upper portion of the chart.

A method of overcoming the congested lower portion of the flow scale is to machine the square-root function into the range chamber of the meter. The differential pen then reads in units of flow instead of in units of differential pressure. This is a UNIFORM FLOW METER and can, of course, be used for control and integration of flows. Owing to problems in machining and leveling, the lower 10 percent of scale is extremely difficult to calibrate with any normal degree of accuracy. Therefore, such a meter is operated over the upper 90 percent of the scale, and an apparent 10 to 1 rangeability factor is obtained.

Use of Two Chambers

A more common way of extending measurement rangeability is called WIDE-RANGE METERING, wherein two sets of measuring chambers are mounted on one case and connected across the same orifice plate. Such an instrument, called a DUAL-RANGE METER, is equipped with two differential pens, each recording a different range of differential pressure. For instance, with a 20-inch and a 100-inch meter, a low flow would be measured by the 20-inch chamber; as the flow increased and the differential exceeded 20 inches, the second (100-inch) pen would then approach its accurate range. This would provide a 7-to-1 rangeability factor.

Multiple Meter Runs

Another way of increasing rangeability is to use MULTIPLE METER RUNS. If the design of the manifold and meter runs

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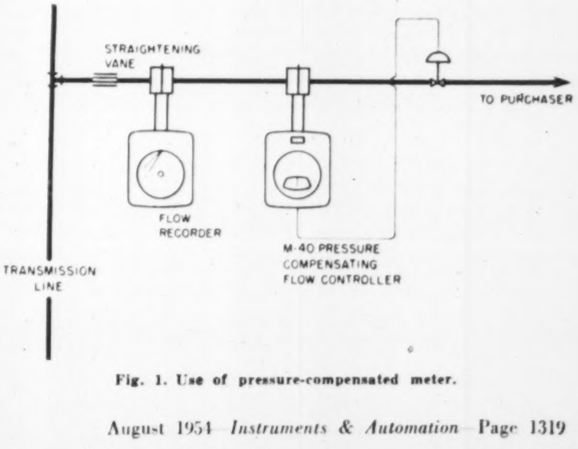

Fig. 1. Use of pressure-compensated meter.

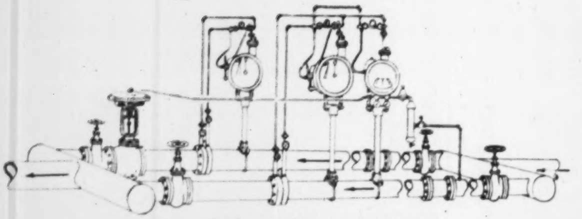

Fig. 2. Differential limit controller.

is such that the same flow passes through each line, the hourly reporting of deliveries to the dispatcher is simplified. The station operator merely calculates the flow through one tube and multiplies that amount by the number of runs in service, thus obtaining the total flow. In some instances one line is furnished with a flow recording-controller instead of the customary meter; this controller operates a control valve located in the line downstream from the manifold.

Another problem of metering can be met with a PRESSURE-COMPENSATED METER, or volume meter (Fig. 1). By building a pressure element into the case and mechanically linking it to the flow pen, the instrument records directly the product of differential pressure and static pressure.

Having discussed methods of increasing rangeability by adapting various means of measurement, the next step is to see how controls can be incorporated to obtain wider range measurement.

Differential Limit Controller

One instrument designed specifically for this purpose is the DIFFERENTIAL LIMIT CONTROLLER (Fig. 2). This is basically a reliable on-off controller with special gap action in the relay mechanism. With this instrument, two or more meter runs are used. The on-off valve (air-to-close action) in the secondary line is operated by the limit controller, which takes its differential at the orifice plate in the primary line. The index settings are made at the high and low differentials at which the secondary line is to be cut in or out. At low-flow conditions the limit controller keeps the valve closed by applying 17-psi. pressure to its diaphragm. As the flow increases past the first set point, the relay applies pressure on the valve in the secondary line. As flow increases to the high setting, the controller vents the valve, opening the secondary line. The relays are held in that position until the flow has dropped to the low setting, at which point the controller will close the valve again. Operation between the two settings will always be determined by the last setting index.

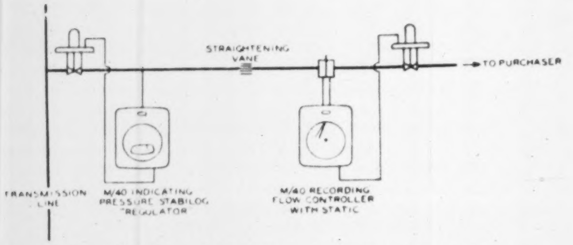
STRAIGHTENING VANE
TO PURCHASER
TRANSMISSION LINE
M/40 INDICATING PRESSURE STABILOG REGULATOR
M/40 RECORDING FLOW CONTROLLER WITH STATIC

Fig. 3. Limiting flow controller to limit maximum flow.

At a constant pressure a two-run setup can have as much as a 12-to-1 rangeability. Using a wide-range setup, as much as 35-to-1 can be obtained; if a third meter run is added, rangeability can be increased to 180-to-1. The use of a flapper-nozzle mechanism permits consistent and precise operation. This is most important because erratic cut-off means loss of the extra rangeability which the differential limit controller is designed to furnish.

Limiting Flow Controller

Still another type of control enables the supplier to assure himself and his customer of a predetermined maximum demand. Here a LIMITING FLOW CONTROLLER (Fig. 3) is employed. In operation, the valve is kept wide open as long as the flow is below the preset maximum, but as the flow increases, the valve will be throttled back to maintain no greater flow than is set by the index. This controller is obviously adaptable to gas loads where the rate schedule includes a penalty for high demand. For wide flow variations a dual run is necessary for good accuracy.

Auto-selector Controller

The last controller to be discussed is the AUTO-SELECTOR CONTROLLER (Fig. 4), a unique instrument which has two sensing elements and two control mechanisms but only one relay operating a single control valve. One useful application in the gas industry is to control gas flow and pressure selectively in order to limit the flow rate to a preset maximum and prevent the pressure on the purchaser's line from exceeding a set value. As long as the withdrawal rate is less than the flow index setting, the controller will hold the downstream pressure at its preset maximum. However, if the flow increases and tries to exceed its index setting, control is smoothly shifted to flow and the downstream pressure will fall below its set point. With this instrument two variables can be selectively controlled, provided the related measurements are susceptible to control with one valve.

Computation

Any discussion of increasing measurements should include the growing tendency toward simpler means of data reduction, which has resulted in a demand for computor-type instruments. One type is the mechanical-electrical integrator, which is simply a totalizer that eliminates laborious planimetering.

In such a meter the position of the pen is sensed by a contactor. The rate of flow proportions the length of time that the electric contacts energize the counter motor. The operation is sequenced every 12 seconds and totals the flow for each cycle.

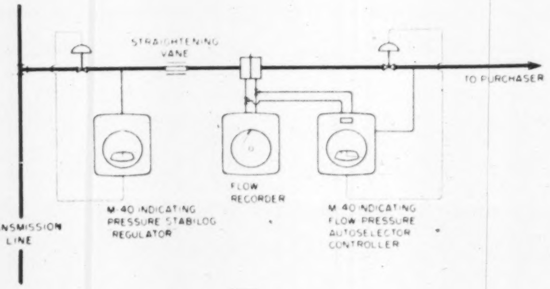
STRAIGHTENING VANE
TO PURCHASER
TRANSMISSION LINE
M-40 INDICATING PRESSURE STABILOG REGULATOR
FLOW RECORDER
M-40 INDICATING FLOW PRESSURE AUTOSELECTOR CONTROLLER

Fig. 4. Auto-selector controller for selective control of both flow and downstream pressure.

It is also practical to totalize pressure with this mechanism. Then, by electrically connecting the two integrators, multiplication of the two values is obtained. The result is Q in the simplified equation

$$Q = K\sqrt{h} \times \sqrt{P_{\text{abs}}}.$$

It thus becomes apparent that accurate totalized results can be obtained without tedious computation and planimetering.

This brief discussion has covered some of the instruments developed to handle specialized gas-industry applications. It is certain that still further developments in instrumentation will take place as the industry and the instrument manufacturers continue to cooperate in the interest of better metering.

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For more information circle **156** on inquiry card.

Briefs . . .

Sine-Cosine Resolvers

The resolver is a miniature rotatable transformer in which the angle between the primary (stator) and secondary (rotor) is continuously adjustable by mechanically turning the rotor. The stator and rotor each have two windings which are 90 electrical degrees apart. The windings are in high permeability laminated cores, machined to extremely precise tolerances. The rotor is mounted in precision miniature ball bearings. . . . The Resolver resolves an input voltage into sine and cosine components whose angle is determined by the position of the rotor. (*From 2-page brochure* 5244, *Ford Instrument Co.*, 31-10 *Thomson Ave., L. I. C.* 1, *N. Y.*)

When input is across S_4S_2, and S_1S_3 is shorted:

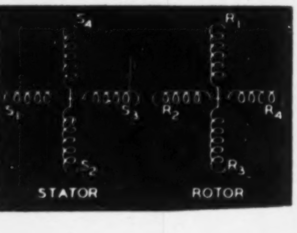
(a) $E_{R_1R_3} = KE_{S_4S_2}\cos\theta$

(b) $E_{R_2R_4} = KE_{S_4S_2}\sin\theta$

When input is across S_1S_3, and S_4S_2 is shorted:

(c) $E_{R_2R_4} = KE_{S_1S_3}\cos\theta$

(d) $E_{R_1R_3} = -KE_{S_1S_3}\sin\theta$

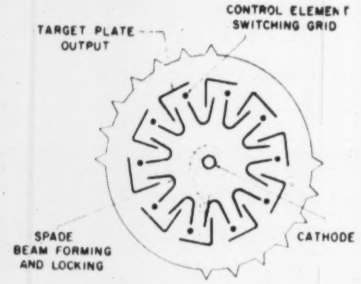


For this literature circle **701** on inquiry card.

Beam Switching Tubes

Beam Switching Tubes are high-vacuum devices employing the beam-forming properties of crossed electric and magnetic fields.

The magnetic field is provided by a small permanent magnet fitted over the exterior of the tube.


TARGET PLATE OUTPUT
CONTROL ELEMENT SWITCHING GRID
SPADE BEAM FORMING AND LOCKING
CATHODE

Internally, the tube is composed of ten groups of electrodes mounted radially about a central cathode. The basic elements of each group are: 1. a spade to form and lock the beam, 2. a grid to switch the beam, 3. a target to give a useful output.

By forming the beam on any one spade an output signal is produced on the corresponding target plate. Since the beam may be automatically formed and locked on any spade, there are ten discrete outputs associated with the tube. (*From new 2-page brochure "Beam Switching Tubes Types MO-*10 *and MO-*10*R, Electronic Instruments Div., Burroughs Corp.*, 1209 *Vine St., Phila, Pa.*)

For this literature circle **702** on inquiry card.

Analog-to-digital Converter

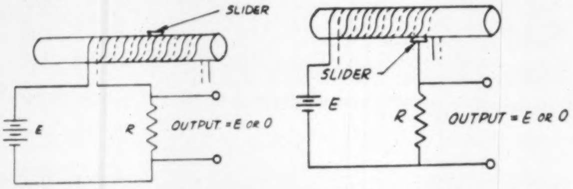
The Kearfott "Sadac" is a device for precise electromechanical conversion of analog information to digital form . . . . works from a synchro voltage input and produces a 12-binary-digit informational output.

The rotating drums are metallic and each one has three separate takeoff tracks and one input track. Each takeoff track is divided into flush conductive and non-conductive segments. The pattern for segment layout is arranged in cyclic binary code for minimum ambiguity. The segmented drums are positioned by a servo driven gear train in response to a voltage signal from a remote synchro transmitter. . . . "Sadac" has 12 takeoff tracks and since it operates with binary digits it has a digitalizing capacity of 2^{12} or 4096 "bits" . . . . accuracy has been brought to one part in 4096 or approximately 5 minutes of transmitter rotation. (*From new 2-page brochure, Kearfott*, 1378 *Main Ave., Clifton, N. J.*)

For this literature circle **703** on inquiry card.

Analog-to-digital Converter

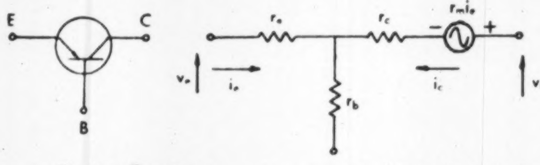
The "Helipulse" translates shaft rotation into electrical pulses. The coil of the "Helipulse" consists of two windings side by side, insulated from each other. As the shaft is turned, it moves a slider over the coil . . . the number of pulses thus produced is proportional to the angle through which the shaft is rotated, within ±1 count. . . . Resolution is high . . . up to 2,000 counts per revolution. Output up to 100 volts contrasts sharply with other transducers having outputs on the millivolt level. Shown are two circuit arrangements. (*From new 2-page issue of "Helitopics," Helipot Corp., S. Pasadena, Calif.*)



For this literature circle **704** on inquiry card.

Transistors

Considered as a linear four terminal network, the point-contact transistor has direct and transfer resistances defined as follows:



r_e = Emitter Resistance	$r_{11} = v_e/i_e$ Collector Circuit Open
r_b = Base Resistance	$r_{12} = v_e/i_c$ Emitter Circuit Open
r_c = Collector Resistance	$r_{21} = v_c/i_e$ Collector Circuit Open
$r_m i_e$ = Equivalent Transitor Voltage Source	$r_{22} = v_c/i_c$ Emitter Circuit Open

(*From new 2-page Bulletin DL-S-*402, *"Point-Contact Transistor," Texas Instruments, Inc.*, 6000 *Lemmon Ave., Dallas, Texas.*)

For this literature circle **705** on inquiry card.

Vibralloy

The metals research group of Bell Telephone Laboratories have been studying the fundamental factors controlling the modulus of elasticity in metals and its variation

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MAXISAFE

Turn the knob on the back of the *Maxisafe* and the plate comes off, fully exposing the entire mechanism for fast and easy inspection, recalibration or adjustment. This time and money-saving feature is highly favored wherever Ashcroft *Maxisafe* Duragauges are in service.

This Duragauge was named *Maxisafe* because it has an integrally-cast wall to separate the dial from the movement and Bourdon Tube assembly — a solid wall of safety that protects the viewer if the tube ever ruptures. Covering the back of the case is a double spring mounted safety release plate — a Teflon-coated plate tightly fitted on a rubber gasket and held in place by a knurled knob. Less than 0.5 psi pressure created by a ruptured tube forces this cover open — vents the discharge safely to the rear.

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ARIDIFIER
SCRUBS, CLEANS AND DRIES
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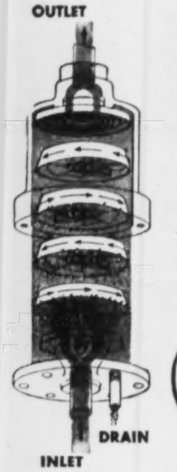
OUTLET
DRAIN
INLET

LASTS LONGER because . . .
The Aridifier's patented centrifugal-baffle action traps 92% of all dirt, oil, scale and water in gas or compressed air . . . and drains off these troublemakers *before* they can damage tools and equipment.

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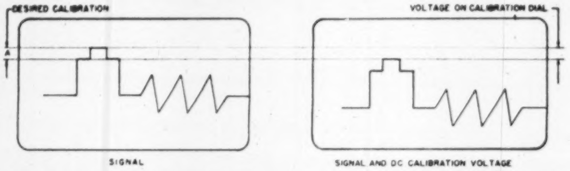
For more information circle **159** on inquiry card.

with temperature. This study recently uncovered a new alloy, which has been named Vibralloy. Its temperature coefficient of elastic modulus may be controlled over a wide range, and in addition it has substantial ferromagnetic permeability and high mechanical strength. This is an attractive combination of properties for many purposes, such as for the reeds of vibrating reed selectors. (*From 4-page reprint, Arnold Engineering Co., Marengo, Ill.*)

For this literature circle **706** on inquiry card.

Oscilloscope Calibration

In essence, there are only two methods (of amplitude signal calibration of oscilloscopes)—substitution and in series with the signal. The universal method has been substitution, although the series method is preferred.


DESIRED CALIBRATION
A
VOLTAGE ON CALIBRATION DIAL
SIGNAL
SIGNAL AND DC CALIBRATION VOLTAGE

The serious objections (to voltmeter-type and symmetrical-type substitution methods) are overcome if the calibrating voltage is introduced in series with the signal, thus never losing the pattern . . . . this method is used in the "S-6-A Broad Band Pulsescope." (*From Vol. 2, No. 4 issue of Pocketscoop," Waterman Products*, 2445 *Emerald St., Phila.* 25, *Pa.*)

For this literature circle **707** on inquiry card.

X-Y Plotter, Punch-card Reader

X-Y recorders may be employed for time-shared multiplots, punch-card plotting, computer outputs, process control monitoring, stress-strain diagrams, vacuum-tube characteristics, transistor characteristics, semi-log plots, log-log plots, radiation pattern studies, wind-tunnel test data.

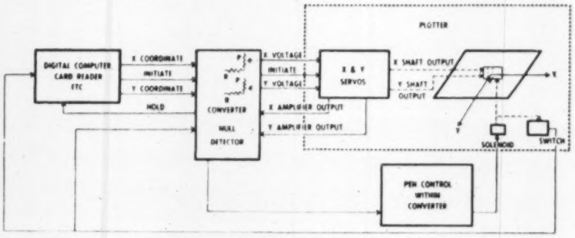

PLOTTER
DIGITAL COMPUTER CARD READER ETC
X COORDINATE
INITIATE
Y COORDINATE
HOLD
CONVERTER
NULL DETECTOR
X VOLTAGE
INITIATE
Y VOLTAGE
X AMPLIFIER OUTPUT
Y AMPLIFIER OUTPUT
X & Y SERVOS
X SHAFT OUTPUT
Y SHAFT OUTPUT
X
Y
SOLENOID
SWITCH
PEN CONTROL WITHIN CONVERTER

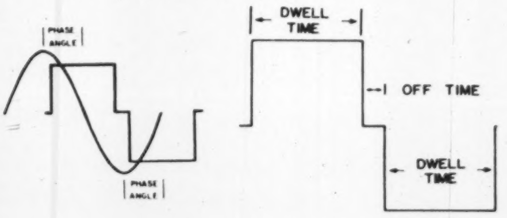
Fig. shows . . . set-up for punched-card plotting. The units required are punched-card reader, punched-card converter, and a plotter. (*From new 6-page brochure, Librascope, Inc.*, 1607 *Flower St., Glendale, Calif.*)

For this literature circle **708** on inquiry card.

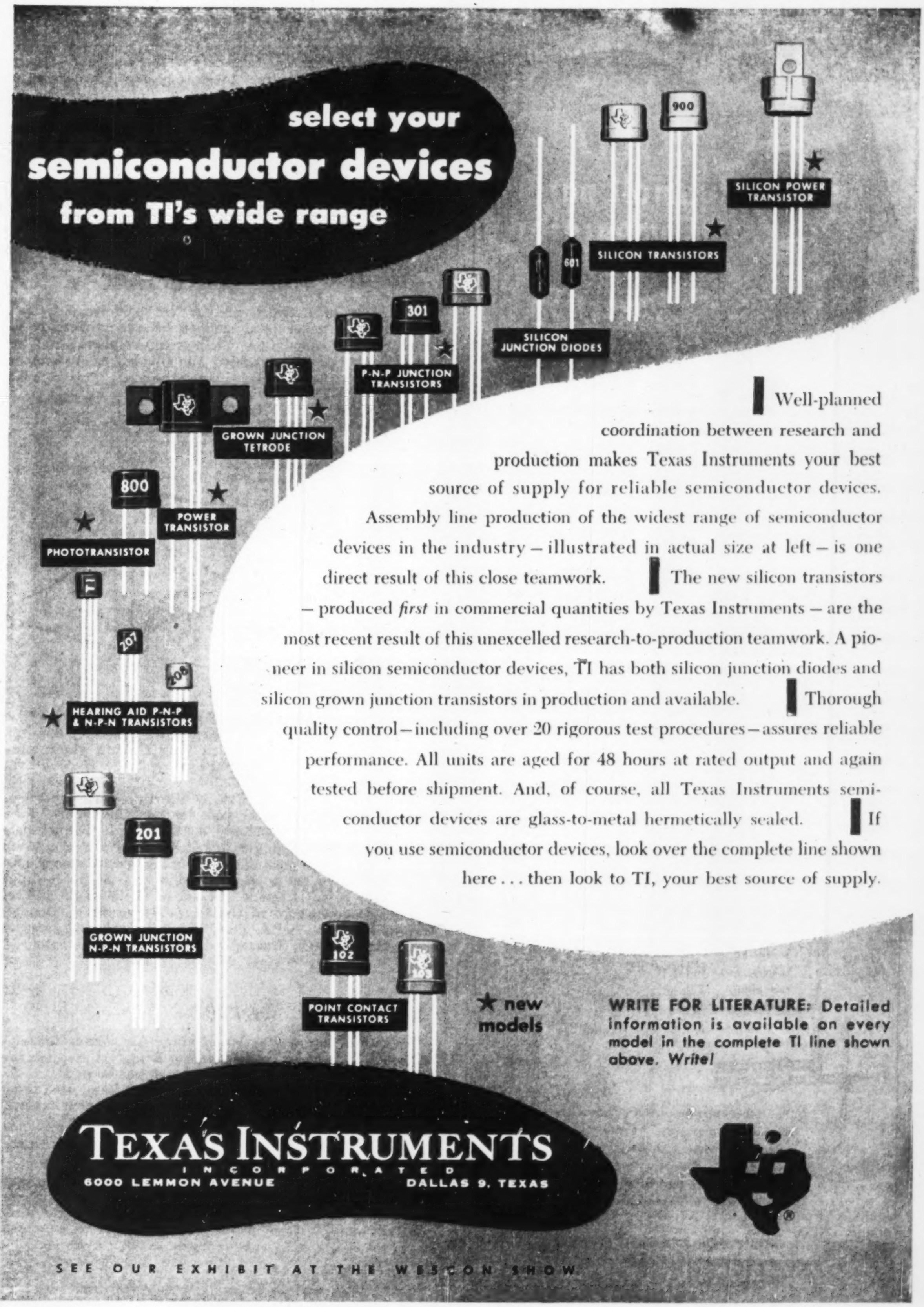
Choppers

In discussing choppers, we compare a driving sine wave against a signal developed from the contacts.

Phase Angle is defined as the angle existing between the


PHASE ANGLE
PHASE ANGLE
DWELL TIME
OFF TIME
DWELL TIME

select your semiconductor devices from TI's wide range



900
SILICON POWER TRANSISTOR
SILICON TRANSISTORS
601
SILICON JUNCTION DIODES
301
P-N-P JUNCTION TRANSISTORS
GROWN JUNCTION TETRODE
800
POWER TRANSISTOR
PHOTOTRANSISTOR
207
208
HEARING AID P-N-P & N-P-N TRANSISTORS
201
GROWN JUNCTION N-P-N TRANSISTORS
102
103
POINT CONTACT TRANSISTORS

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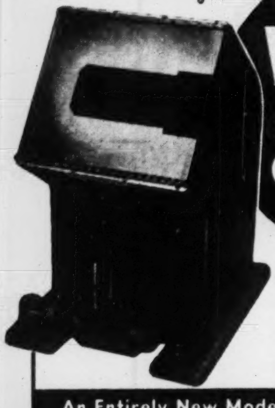
new
WILDER
small parts
Comparator
model C



• Vertical Design
• Erect Image
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ACCURATE - FAST - INEXPENSIVE
Promotes Inspection Economy

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For more information circle 161 on inquiry card.

AGF "Super Blowpipes"

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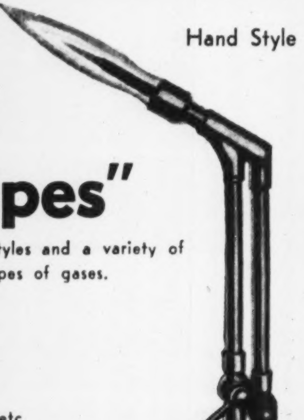

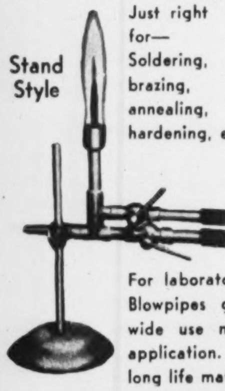
Stand Style

Just right for—
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brazing,
annealing,
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988 LAFAYETTE STREET, ELIZABETH 4, N. J.

For more information circle 162 on inquiry card.

peak of the driving sine voltage and the midpoint between contact closure and contact break, expressed in degrees of the driving wave.

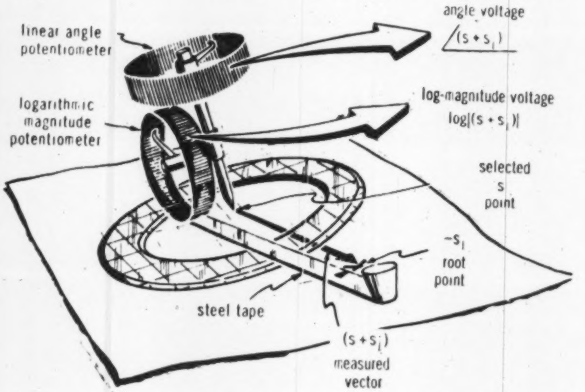
Dwell Time is the number of degrees each contact is closed. Balance is the difference of dwell time between positive and negative waves.

Off Time is expressed as the time in degrees during which neither contact is closed. (*From new 4-page brochure "C747 Midget," Airpax Products, Middle River, Baltimore 20, Md.*)

For this literature circle **709** on inquiry card.

Complex-plane Analyzer

Evaluation of network and system performance, as a function of the generalized complex frequency s, can be reduced to vector calculations on the complex plane. . . . Complex vectors can be multiplied and divided easily and accurately with the Complex Plane Analyzer. This compact analog computer consists of (1) a Vector Measuring Unit which converts vector dimensions into precision d-c. voltages, and (2) a Vector Multiplying Circuit which stores and combines the vector voltages to yield the desired product vector.

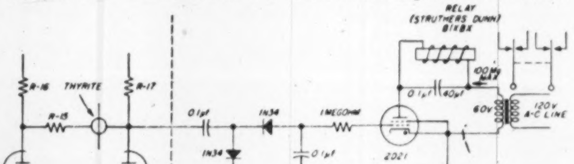

linear angle potentiometer
angle voltage
$\angle(s+s_i)$
logarithmic magnitude potentiometer
log-magnitude voltage
$\log|(s+s_i)|$
selected s point
$-s_i$ root point
steel tape
$(s+s_i)$ measured vector

The Vector Measuring Unit is like an electric tape measure. Its self-winding steel tape controls the sliders of two TIC precision potentiometers: a linear angle potentiometer and a logarithmic magnitude potentiometer. If the Vector Measuring Unit is positioned at any desired frequency s and the tape drawn out to a root point $-s_1$, the d-c. voltages of the two potentiometers correspond to the angle and log-magnitude dimensions of the $(s + s_1)$ vector. (*From new 6-page brochure "CPA Type 250-A," Technology Instrument Corp., Acton, Mass.*)

For this literature circle **710** on inquiry card.

Automatic Sorter

An interesting application of automatic-sorting technique is shown . . . where the Comparison Bridge is used for sorting capacitors . . . . at a rate of two per second. . . . The error voltage (from the bridge) is rectified and used to bias a thyratron to cut-off. If the unknown component is within

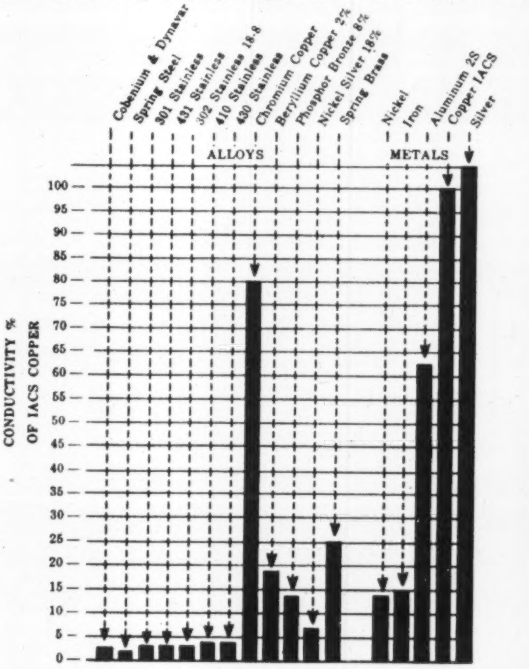

RELAY (STRUTHERS DUNN) BIXBX
R-16
THYRITE
R-17
R-15
.01µf
1N34
1N34
1 MEGOHM
.01µf
.01µf
40µf
100 MA MAX
60V
120V A-C LINE
2D21
V-1 12AT7
IN BRIDGE
EXTERNAL CIRCUIT

tolerance, the bias will be reduced to the point where the thyratron will operate the relay. Sufficient sensitivity is available to select components within 0.02 per cent of the desired value. (*From 8-page Vol. 28, No. 9 issue of "Experimenter," General Radio Co., Cambridge, Mass.*)

For this literature circle **711** on inquiry card.

Relay Symposium

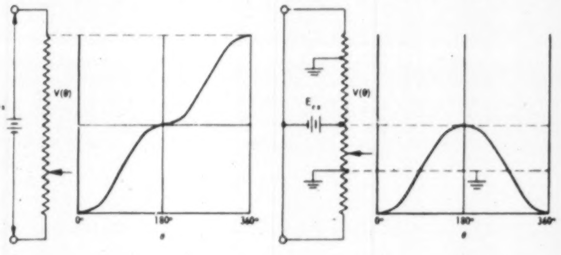
Selection of materials for contacts is a very controversial subject. It is one of the best examples of a case where a given material may satisfy requirements in one instance, but in a very similar case be entirely unsuited. The reason obviously is that while a contact makes and breaks a given current, many other factors are involved. (*From 84-page "Symposium on Electro-Magnetic Relays" given at Oklahoma A & M College, Potter & Brumfield, Princeton, Ind.*)



For this literature circle **712** on inquiry card.

Potentiometer Handbook

If a high degree of precision is required in generation of nonlinear functions, it usually is desirable to custom design the potentiometer resistance element. . . . the various techniques available to the designer (include) continuous and discontinuous change in winding resistivity, card width variation, stepped card, change in wire composition, change in wire size, wire-size wire-spacing control, shunting, tapping, shorting. (*From new 208-page "Potentiometer Handbook," Technology Instrument Corp., Acton, Mass. Price:* $2.00)



a) WITHOUT TAPPING

b) WITH TAPPING

For this literature circle **713** on inquiry card.

new! WEKSLER
Junior ADJUST-ANGLE THERMOMETER

Now, the 5" submarine thermometer can be obtained with the Weksler Adjust-Angle feature. The complete line covers 5", 7", 9" and 12" case sizes.

- QUICK-SETTING . . . adjusts to any angle!
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MANUFACTURERS' NEW LITERATURE

In this department we report new literature, pertaining to instrumentation, received from the manufacturers. We urge readers to request ONLY those bulletins which will be of value to them. Use the Postage-free Order Card on Page 1347.

Requests for literature FROM ABROAD should be made on company letterhead and mailed DIRECTLY to the manufacturers.

AUTOMATION

Process Instrumentation. New 16-page annual Bulletin 17 presents detailed equipment descriptions and illustrations including specifications for measuring, transmitting, receiving, interpreting and controlling 18 variables normally encountered in production processes.—Bailey Meter Co., 1050 Ivanhoe Rd., Cleveland 10, Ohio.

Circle **714** on inquiry card.

Control Instruments. New 16-page illustrated Bulletin 400 "Instrumentation for the Meat Industry" describes applications of industrial instruments in meat processing.—Minneapolis-Honeywell Regulator Co., Industrial Div., Phila. 44, Pa.

Circle **715** on inquiry card.

Industrial Instruments. New 8-page Bulletin B-I-F 3 illustrates and describes maker's line of proportioning equipment, volumetric and gravimetric feeders; and instruments for metering and controlling flow, liquid level, temperature, pressure and weight.—B-I-F Industries, Inc., P. O. Box 1342, Providence 1, R. I.

Circle **716** on inquiry card.

Annunciator. New 4-page brochure and 2-page wiring diagram pictures and describes maker's new "Electro-Larm" unit-type annunciator for automatic process monitoring.—Electro Devices, Inc., 4025 Easton Ave., St. Louis 13, Mo.

Circle **717** on inquiry card.

Combustion Safety. New 8-page Bulletin 9604 describes and illustrates maker's new miniature flame rod assemblies, photocell units, and other components used in "Protectoglo" automatic combustion safeguard systems for industrial oil and gas burners.—Minneapolis-Honeywell Regulator Co., Industrial Div., Phila. 44, Pa.

Circle **718** on inquiry card.

Indexing Units. New 4-page Bulletin 12 illustrates and describes maker's automatic, cam-operated indexing (positioning) unit for automatic industrial positioning and conveyor control.—Standard Tool & Manufacturing Co., Arlington, N. J.

Circle **719** on inquiry card.

Density Control. New 2-page Data Sheet 3.8-5 describes density control system (using "Densitrol") for liquid-sugar volume production.—Minneapolis-Honeywell Regulator Co., Industrial Div., Phila. 44, Pa.

Circle **720** on inquiry card.

Water-distribution Control Systems. New 4-page issue of "Autocon Rambler" (Vol. 6 No. 1) contains articles presenting description and applications of maker's control systems, including float switches, tank controls, etc.—Automatic Control Co., 1005 University Ave., St. Paul 4, Minn.

Circle **721** on inquiry card.

Machinery Control. New 4-page illustrated brochure covers description and applications of maker's timers, temperature and pressure controls and air diaphragm-motor valves.—Seely Instrument Co., Inc., 377 Fourth St., Niagara Falls, N. Y.

Circle **722** on inquiry card.

Coordination Control.—New 8-page Bulletin 68123 lists applications and specifications of maker's two-level coordination control for operating integral air valves.—Pantex Manufacturing Corp., P. O. Box 660 Pawtucket, R. I.

Circle **723** on inquiry card.

Safety Control. New 4-page brochure covers specifications and description of maker's power-press safety control consisting of control box, Geiger-tube detectors and leather wristbands containing harmless amounts of radioactivity.—Hazatrol Corp., 215 Market, Rm. 1216, San Francisco, Calif.

Circle **724** on inquiry card.

MOTORS

Geared Motor. New 4-page Bulletin SG15 presents construction, illustrations, speeds, etc. of maker's "Model SG15" geared motor.—Merkle-Korff Gear Co., 213 N. Morgan St., Chicago 7, Ill.

Circle **725** on inquiry card.

Servo Motors. New 4-page Catalog 4 presents diagrams and descriptions of maker's a-c. servo motors and tachometer generators.—G-M Laboratories, Inc., 4300 North Knox Ave., Chicago 41, Ill.

Circle **726** on inquiry card.

Motor Controls. New 4-page Bulletin 00-3/53 describes and illustrates maker's polyphase magnetic contactor, surface-mounting drum controller, fuse blocks, pressure switches, control centers, load centers, etc.—American Kloeckner-Moeller Corp., 522 Thompson Bldg., Tulsa 3, Oklahoma

Circle **727** on inquiry card.

Motors. New 4-page issue of "The Bodine Motorgram" (Vol. 34 No. 40) features articles on setting type photographically, and on reversing fractional-horsepower motors.—Bodine Electric Co., 2250 W. Ohio St., Chicago 12, Ill.

Circle **728** on inquiry card.

VALVES

Solenoid Valves. New 4-page Bulletin M-500 presents design and performance characteristics, illustrations and specifications of maker's six sizes of diaphragm-operated solenoid valves.—Eclipse Fuel Engineering Co., 1012 Buchanan St., Rockford, Ill.

Circle **729** on inquiry card.

Hydraulic, Pneumatic Controls. New 34-page Catalog 4G describes and illustrates maker's line of manual, solenoid, and solenoid pilot-controlled valves, and pressure switches.—Barksdale Valves, 5125 Alcoa Ave., Los Angeles 58, Calif.

Circle **730** on inquiry card.

Flanged Valves. New 4-page illustrated Bulletin WH-654 describes maker's flanged silent-check valves for control of water hammer. Includes dimensional charts for sizes and pressure ratings of valves.—Williams Gauge Co., Inc., 1620 Pennsylvania Ave., Pittsburgh 33, Pa.

Circle **731** on inquiry card.

Control Valves. New 8-page Bulletin 303A presents analysis of characteristics of maker's "10000 Series" control valves.—Mason-Neilan Regulator Co., 1190 Adams St., Boston 24, Mass.

Circle **732** on inquiry card.

Level Gages, Valves. New 8-page Catalog 236 describes and illustrates maker's line of liquid-level gages and valves, includes specifications.—Jerguson Gage & Valve Co., 80 Fellsway, Somerville 45, Mass.

Circle **733** on inquiry card.

Plug Valve Actuators. New 8-page Bulletin 3020 describes tandem-type actuators for valves requiring high torques, and new floating bar type actuators for valves requiring lower operating torques. Also presents actuator selection table, applications, weights, dimensions and mountings.—Ledeen Mfg. Co., 1600 South San Pedro St., Los Angeles 15, Calif.

Circle **734** on inquiry card.

Valves. New 84-page Catalog 82 describes and illustrates maker's line of safety-relief valves for boilers, compressors, heat exchangers, kettles, pressure piping, pressure vessels, process equipment and regulators.—Marine & Industrial Products Co., 3731 Filbert St., Phila. 4, Pa.

Circle **735** on inquiry card.

Valve Operators. New 8-page Catalog T-81 pictures and describes maker's line of electrically-controlled valve operating units.—McBain Corp., 6251 West Century Blvd., Los Angeles 45, Calif.

Circle **736** on inquiry card.

Solenoid Valve. New 2-page Bulletin 8345 covers features, description, applications and operation of maker's 4-way midget solenoid valve.—Auto-

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matic Switch Co., 391 Lake Ave., Orange, N. J.

Circle **737** on inquiry card.

Packless Valves. New 2-page Bulletin 870 presents description, diagrams and applications of maker's pneumatically- or hydraulically-operated packless valves.—Clifford Mfg. Co., Waltham, Mass.

Circle **738** on inquiry card.

Needle Control Valves. New 8-page Bulletin 5C-13 presents design details and operating characteristics of maker's line of needle-type control valves for low rates of flow.—Foxboro Co., Foxboro, Mass.

Circle **739** on inquiry card.

Solenoid Valves. New 2-page Bulletin A-3 describes and illustrates additions to maker's line of general-service solenoid valves.—J. D. Gould Co., 730 East Washington St., Indianapolis, Ind.

Circle **740** on inquiry card.

TEMPERATURE

Temperature Control. New 4-page issue of "Wheelco Comments" (Vol. 14 No. 4) presents articles on maker's new "400-Series Capacitrols" temperature controllers and combustion safeguard detecting systems.—Wheelco Instruments, Barber-Colman Co., Rockford, Ill.

Circle **741** on inquiry card.

Thermostat Metal. New 6-page Data Sheet 400 describes maker's "ASC-1" thermostat metal strip. Includes tables, charts, formulas and specifications sheet.—Thermostat Metal Div., American Silver Co., Inc., 36-07 Prince St., Flushing 54, N. Y.

Circle **742** on inquiry card.

Temperature Control Systems. New 4-page Data Sheet 5.2-6 describes methods of automatic control of annealing covers. Includes two-position, cut-back, switchover and recycle, control methods.—Minneapolis-Honeywell Regulator Co., Industrial Div., Phila. 44, Pa.

Circle **743** on inquiry card.

Temperature Indicator. New 2-page Leaflet 196 describes maker's thermistor-type climate-survey temperature indicator and accessories.—Beckman & Whitley Inc., 1096 E. San Carlos Ave., San Carlos, Calif.

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Tentative Thermocouple Standards. New 14-page "Temperature-EMF Relation for Iron-Constantan Thermocouples" and 2-page "Air Pressures for Pneumatic Controllers and Transmission Systems 3-15 psi., 3-27 psi., and 6-54 psi. Operation Pressure Ranges" present tentative standards produced by committees of the Recorder-Controller Section, SAMA.—Scientific Apparatus Makers Association, 522 Fifth Ave., New York 36, N. Y.

Circle **745** on inquiry card.

PRESSURE

Pressure Transducers. New 8-page issue of "Instrument Notes" No. 27 features article on evaluation of designs of transducers for the measurement of dynamic pressures in liquid systems.—Statham Laboratories, Inc., 12401 West Olympic Blvd., Los Angeles 64, Calif.

Circle **746** on inquiry card.

Leak Detector. New 2-page illustrated brochure describes maker's portable leak detector for field and production use.—Kinetic Engineering Co., M-217 Deleware Trust Bldg., Wilmington 1, Del.

Circle **747** on inquiry card.

Dual Impregnator. New 4-page illustrated brochure describes maker's dual impregnating unit for efficient impregnation under vacuum.—Red Point Products, Inc., 1907 Riverside Dr., Glendale 1, Calif.

Circle **748** on inquiry card.

Transducers. New 8-page Brochure 3-54 10M PR 1 illustrates and describes maker's force or displacement transducers, physiological pressure transducers and power supply control units.—Statham Instruments, Inc., 254 Carpenter Rd., Hato Rey, Puerto Rico.

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FLOW

Flow Tube. New 16-page Bulletin 115-L3 describes and illustrates maker's flow tube, a short-differential producing device said to have lowest

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permanent-loss of head of any known velocity-increasing differential producer.—Builders-Providence, Inc., 345 Harris Ave., Providence, R. I.

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Anemometer. New 4-page brochure describes maker's "Model HWB" hot-wire anemometer for quantitative measurement of velocity.—Flow Corp., 283 Concord Ave., Cambridge 38, Mass.

Circle **751** on inquiry card.

Pneumatic Transmitter. New 4-page illustrated Bulletin 170 gives operating details and specifications of new force-balance, rotameter float-position transmitter for use with pneumatic receivers and control instruments.—Brooks Rotameter Co., Lansdale, Pa.

Circle **752** on inquiry card.

Liquid Metering, Controlling. New 2-page Catalog 70-50 describes and illustrates maker's small, low-cost feeder for metering, controlling, mixing, and dispensing small quantities of liquid chemicals.—Fischer & Porter Company, 149 Jacksonville Rd., Hatboro, Pennsa.

Circle **753** on inquiry card.

Flowmeter. New 4-page Bulletin 1052 presents design, features, maximum flow capacities, maintenance requirements, and mounting drawings of maker's new "Type 12-90 Series" multiple-stage flowmeter.—Commercial Research Laboratories, Inc., 20 Bartlett Ave., Detroit 3, Mich.

Circle **754** on inquiry card.

Flow Transducer. New 4-page bulletin presents applications and specifications of maker's "Mark V" flow transducer for remote indicating, recording, or controlling of flow rates.—Ramapo Engineering Co., 1 Dey Lane, Riverdale, N. J.

Circle **755** on inquiry card.

Flowmeters. New 28-page Catalog 1056 illustrates and describes maker's variable-area flowmeters with "Inner-Wall" guide metering tubes.—Commercial Research Laboratories, Inc., 20 Bartlett Ave., Detroit 3, Mich.

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Automatic Proportioner. New 2-page Catalog 70-20 presents description, flow diagram, cross-section, installation and specifications of automatic proportioning unit for maker's chlorinator.—Fischer & Porter Co., Hatboro, Pa.

Circle **757** on inquiry card.

PUMPS

Hydraulic Pumps. New 4-page brochure describes and illustrates applications and operation characteristics of maker's "Model S-216-C" series of air-driven, high-pressure, hydraulic pumps.—Sprague Engineering & Sales Corp., 1144 West 135th St., Gardena, Calif.

Circle **758** on inquiry card.

Pumps. New 8-page issue of "Worthite News" (Vol. 5, No. 1) presents history of soap industry and describes and illustrates applications of maker's pumps by soap manufacturers.—Worthington Corp., Harrison, N. J.

Circle **759** on inquiry card.

Controlled-volume Pumps. New 4-page Technical Paper 63 discusses installation and maintenance of controlled-volume pumps. Includes "Trouble Shooting Chart" of common difficulties, causes and remedies.—Milton Roy Co., Station R, 1300 East Mermaid Lane, Phila. 18, Pa.

Circle **760** on inquiry card.

COUNTING, COMPUTING

Data Reduction. New 4-page issue of "Ratonews" (Vol. 3 No. 5) discusses maker's new facilities for manufacturing automatic data loggers, digital scanning and control systems, digital converters and supervisory control systems.—Fischer & Porter Co., Hatboro, Pa.

Circle **761** on inquiry card.

Data Processing Machines. New 4-page illustrated Bulletin 52-6300-0-20-5-54 describes maker's new "Type 702" electronic data-processing machines.—International Business Machines Corp., 590 Madison Ave., New York 22, N. Y.

Circle **762** on inquiry card.

Computor, Recorder, Generator. New 6-page brochures present features, applications and specifications of maker's "MC-500" and "MC-500A" analog computors, "MC-600" six channel electronic function generators, and "MC-300" six-channel recorders. Recorder bulletin includes description of "MC-610" camera unit and "MC-611" developing unit.—Mid-Century Instrumatic Corp., 611 Broadway, New York, N. Y.

Circle **763** on inquiry card.

Operational Amplifier. New 2-page illustrated brochure presents specifications and applications of maker's "Model K2-X" operational amplifier.—George A. Philbrick Researches, Inc., 230 Congress St., Boston, Mass.

Circle **764** on inquiry card.

Industrial Electronic Counters. New 12-page illustrated Brochure DEP-12--53-50 presents features and description of maker's line of industrial electronic counters.—Electronic Products Div., Post Machinery Co., 150 Elliot St., Beverly, Mass.

Circle **765** on inquiry card.

Interval Timers. New 2-page Data Sheet 400 lists features and specifications of maker's counter chronographs "Models 432, 453, 463, 456, and 471" and photoelectric screens "Models 601 and 601A" for high-speed electronic counting, timing and data handling.—Potter Instrument Co., Inc., 115 Cutter Rd., Great Neck, N. Y.

Circle **766** on inquiry card.

RECORDERS

Logger System. New 4-page Bulletin 1570 pictures and describes maker's multi-point logger system that measures and records temperatures or other variables from 144 different points.—Minneapolis-Honeywell Regulator Co., Industrial Div., Phila. 44, Pa.

Circle **767** on inquiry card.

Supersaturation Recorder. New 2-page Instrumentation Data Sheet 3.8-4 describes maker's brown-sugar supersaturation recorder, which introduces technique of seeding by computing supersaturation automatically and continuously.—Minneapolis-Honeywell Regulator Co., Industrial Div., Phila. 44, Pa.

Circle **768** on inquiry card.

Oscillographic Recording. New 8-page issue of "The Right Angle" (Vol. 1 No. 4) contains articles on maker's "150 Series" recording equipment, bridge circuits, and potentiometer inspection.—Sanborn Co., Cambridge 39, Mass.

Circle **769** on inquiry card.

Recorder Amplifier. New 2-page bulletin describes and illustrates maker's "R-2" chopper-stabilized, two-channel recorder amplifier.—Leonard L. Nalley Co., 833 W. Plum St., Compton, Calif.

Circle **770** on inquiry card.

Frequency Recorder. New 2-page Data Sheet 9.1-8a presents principle of operation, specifications and illustrations of maker's frequency generator with pulse-type measuring circuit.—Minneapolis-Honeywell Regulator Co., Industrial Div., Phila. 44, Pa.

Circle **771** on inquiry card.

Six-channel Recorder. New 6-page illustrated brochure presents features and specifications of maker's "MC-300" six-channel recorder for use with d-c. analog computers.—Mid-Century Instrumatic Corp., 611 Broadway, New York 12, N. Y.

Circle **772** on inquiry card.

Electronic Graph Paper. New 4-page issue of "The Lighting Empiricist" features article on electronic graph paper.—George A. Philbrick Researches, Inc., 230 Congress St., Boston, Mass.

Circle **773** on inquiry card.

Recording, Controlling Instruments. New 14-page illustrated Bulletin 9050, "Instrumentation for Steam Generation" presents maker's line of indicating, non-indicating, transmitting, recording and controlling instruments applicable to steam generation.—Minneapolis-Honeywell Regulator Co., Industrial Div., Phila. 44, Pa.

Circle **774** on inquiry card.

Film Processor. New 2-page illustrated brochure describes maker's "Type 23-109" automatic photo-film processor for paper oscillograms and other rolled paper photo-records.—Consolidated Engineering Corp., 300 North Sierra Madre Villa, Pasadena 15, Calif.

Circle **775** on inquiry card.

Photo-copier. New 4-page brochure pictures and describes operation and applications of maker's "Contoura" portable photo-copier.—F. G. Ludwig, Inc., Deep River, Conn.

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RADIOACTIVITY

Radiation Measurement. New 40-page Catalog N pictures and describes maker's line of radiation measuring equipment including scalers; count-

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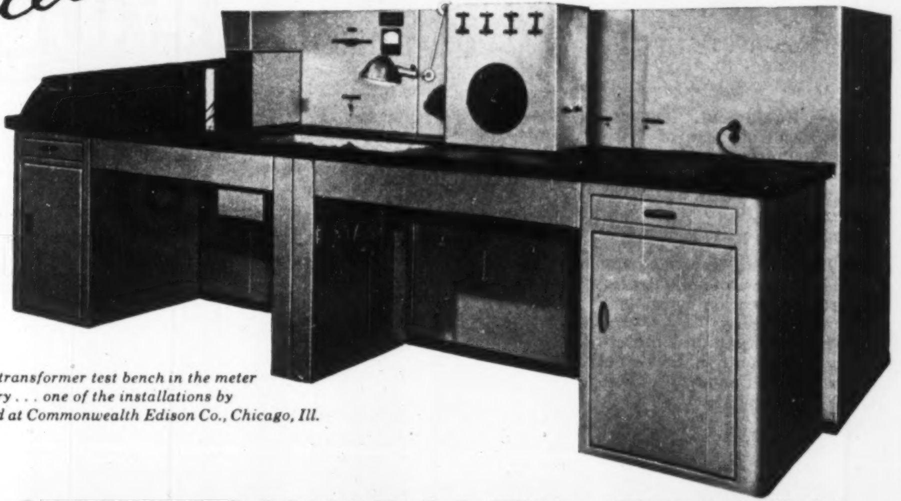

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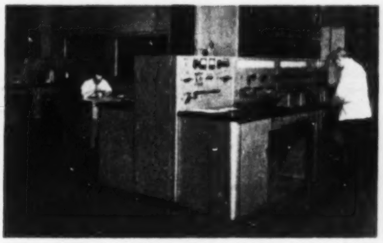

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rate meters; Geiger, proportional and scintillation counters; complete radioisotope laboratories, etc.—Nuclear Instrument & Chemical Corp., 223-233 West Erie St., Chicago 10, Ill.

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Radioactivity Equipment. New 4-page brochure describes use of scintillation counting equipment in exploration for oil or prospecting for uranium.—Nuclear-Chicago, 229 West Erie St., Chicago 10, Ill.

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Radiation Detection. New 12-page Catalog G-12 describes and illustrates maker's radiation detection equipment including direct reading dosimeters, pocket chambers, roentgen dose meters and equipment for isotope measurement and analysis.—Landsverk Electrometer Co., 550 West Garfield Ave., Glendale 4, Calif.

Circle **779** on inquiry card.

VIBRATION

Vibrograph. New 2-page illustrated bulletin presents features and applications of maker's universal vibrograph, a recording instrument for measuring vibrations and accelerations.—Epic Inc., 154 Nassau St., New York 38, N. Y.

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Ultrasonic Generator. New 4-page illustrated brochure presents description, specifications and applications of maker's ultrasonic generator for metal cleaning.—Branson Instruments, Inc., 194 Richmond Hill Ave., Stamford, Conn.

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Vibration, Shock Mounts. New 4-page illustrated Bulletin 850 describes maker's vibration and shock mountings that feature cushions of "Met-L-Flex" knitted metal wire.—Robinson Aviation, Inc., Teterboro, N. J.

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Vibration Control. New set of bulletins describe and illustrate maker's line of vibration control equipment. Includes vibration isolators, shockmounts, vibrapads, and control systems to Army-Navy specifications.—T. R. Finn & Co., Inc., 333 Jackson Ave., New York 54, N. Y.

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SPEED, ACCELERATION

Linear Accelorometers. New 4-page Bulletin AL-1 presents description, diagrams and specifications of maker's linear accelerometers for static and dynamic measurements.—Statham Laboratories, Inc., 12401 West Olympic Blvd., Los Angeles 64, Calif.

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Tachometers. New 2-page Bulletin 765 lists features and specifications of "Model JX" double-range hand tachometer with stop button to hold readings until released.—Herman H. Sticht Co., Inc., 27 Park Place, New York, N. Y.

Circle **785** on inquiry card.

Tachometer Generators. New 2-page Data Sheet 541 presents description, construction details and diagrams of maker's permanent-magnet d-c. tachometer generators.—Instrument Motors. P. O. Box 5, Acosta St., Stamford, Conn.

Circle **786** on inquiry card.

Hand Tachometer. New 2-page bulletin describes and pictures maker's "Model 3200" double-range hand tachometer with stop button.—Jones Motrola Corp., 432 Fairfield Ave., Stamford, Conn.

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TESTING, INSPECTION

Production Test Equipment. New 64-page Catalog GEC-1016A describes and illustrates maker's measuring equipment for laboratory and production testing, including radiation test instruments, recorders, vibration testers, diffraction analyzers, etc.— General Electric Co., Schenectady 5, N. Y.

Circle **788** on inquiry card.

Optical Projectors. New 6-page illustrated brochure presents specifications and descriptions of maker's vertical contour, vertical universal, horizontal contour and horizontal universal optical projectors.—Stoker & Yale Inc., Greene St., Marblehead, Mass.

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Surface Roughness. New 2-page Bulletin LT92-4-54-3 presents description and specifications of maker's "Type AD" linear pilotor for operating "G-Type" Profilometer tracers.—

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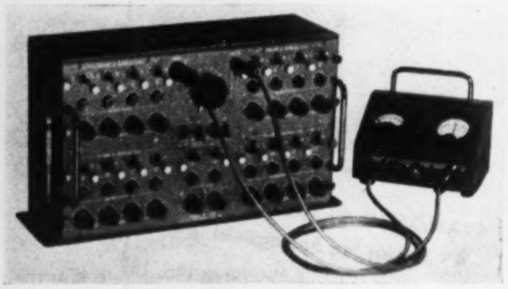

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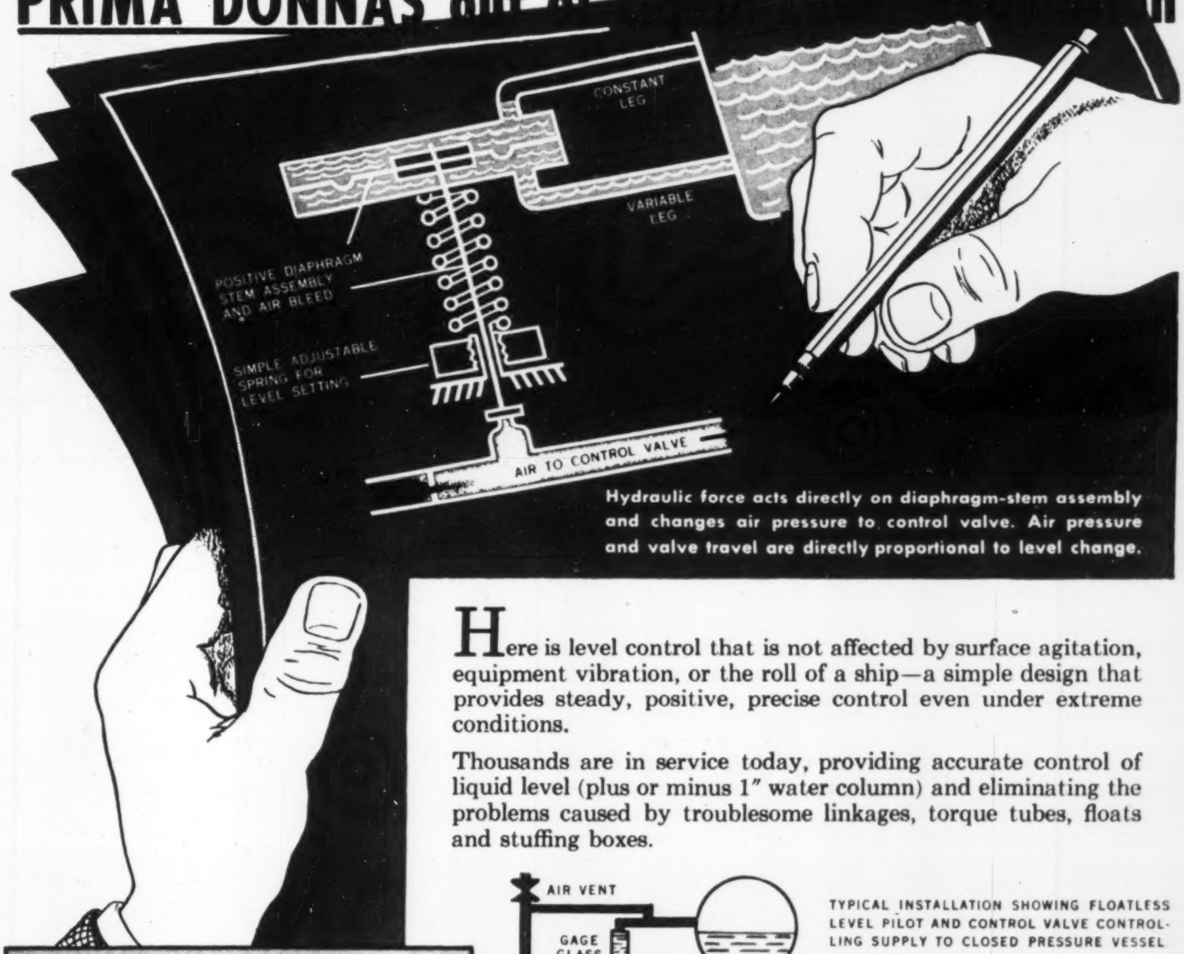
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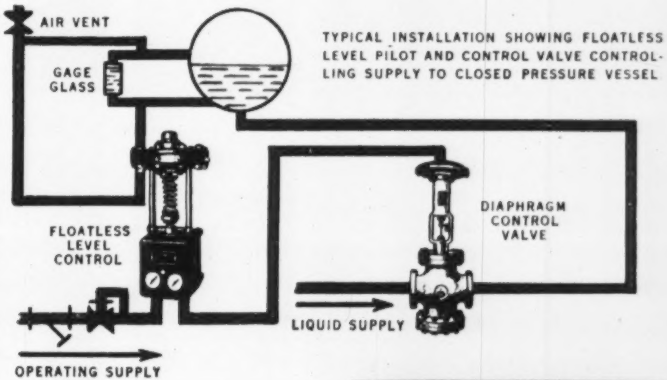
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For more information circle **172** on inquiry card.

MANUFACTURERS' NEW LITERATURE

Micrometrical Mfg. Co., 345 South Main St., Ann Arbor, Mich.

Circle **790** on inquiry card.

Lighting Instruments. New 2-page Bulletin (May 1954) presents description and illustrations of full-range focusing speed-illuminator, test tube viewer; and "Head-Penlite", 2-way flashlight.—The Head Line Co., Utopia Station, P. O. Box 27, Flushing, L. I., N. Y.

Circle **791** on inquiry card.

Spherometers. New 4-page Circular 542 illustrates and describes maker's "Models L-1" and "P-1" ball-point spherometers.—Scientific Optical and Instrument Work, 50 South San Gabriel Blvd., Pasadena 10, Calif.

Circle **792** on inquiry card.

Test Cabinets. New 2-page Data Sheet 11.0-8 pictures and describes line of environmental test cabinets for JAN and MIL test, product evaluation, and research.—Minneapolis-Honeywell Regulator Co., Industrial Div., Phila. 44, Pa.

Circle **793** on inquiry card.

Concrete-tester. New 2-page illustrated brochure describes maker's "Model CT-711" 200,000 lb. capacity portable concrete-testing machine.—Soiltest Inc., 4520 W. North Ave., Chicago 39, Ill.

Circle **794** on inquiry card.

Hardness Testers. New 80-page illustrated catalog covers engineering data, uses and design features of maker's line of hardness testers. Divided into four sections, the catalog details the normal hardness tester, superficial tester, accessory and special tester, and micro and macro hardness testers.—Wilson Mechanical Instrument Div., American Chain & Cable Co., Bridgeport, Conn.

Circle **795** on inquiry card.

Stress-Rupture Apparatus. New 4-page bulletin describes and pictures maker's creep and stress-rupture testing apparatus for testing special alloy steels used in high-temperature services.—Labquip Corp., 3521 N. Cicero Ave., Chicago 41, Ill.

Circle **796** on inquiry card.

Inspection Gages. New 4-page Bulletin 154-4-500 describes maker's air-gages for jet-engine turbine blades and piston-skirt contour. 4-page reprint from "Steel" discusses air gaging. 30-page Catalog 613 describes and illustrates "CompAIRator" air gages.—Taft-Peirce Mfg. Co., Woonsocket, R. I.

Circle **797** on inquiry card.

Gaging Equipment. New 12-page illustrated Bulletin 542 describes electronic equipment for dimensional inspection and control applications in tool rooms, gage rooms and production departments.—Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.

Circle **798** on inquiry card.

DYNAMOMETERS

Dynamometer Systems. New 12-page illustrated Bulletin GEA-5923A presents speed and torque range data and measuring and testing applications of maker's dynamometer systems.—General Electric, Schenectady 5, N. Y.

Circle **799** on inquiry card.

Dynamometers. New 4-page illustrated Bulletin 154 presents description, operation and limitations of maker's dynamometers for measuring electric motors of 2 hp. and less.—Mission-Western Engineers, Inc., 132 West Colorado, Pasadena 1, Calif.

Circle **800** on inquiry card.

Dynamometer Scales. New 14-page catalog D-7-51-5M describes and illustrates maker's dynamometer scales for measuring tension and force.—John Chatillon & Sons, 85-93 Cliff St., New York 38, N. Y.

Circle **801** on inquiry card.

LAB APPARATUS

Lab Apparatus. New 16-page 21st edition of "What's New for the Laboratory" describes and illustrates maker's line of laboratory apparatus including glassware washing machines, drying ovens, distillation equipment, polyethylene items, etc.—Scientific Glass Apparatus Co., Inc., 100 Lakewood Terrace, Bloomfield, N. J.

Circle **802** on inquiry card.

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Lab, Plant Ovens. New 12-page catalog describes and pictures maker's "Blue M" ovens. Includes stainless-steel gravity-convection, forced-draft, high-temperature and mechanical-convection ovens.—Schaar & Co., 754 W. Lexington St., Chicago 7, Ill.

Circle **803** on inquiry card.

Diffractometer, and Spectrograph Charts. Two new 4-page bulletins show actual charts made on X-ray analysis instruments for Illium, Samarskite, C56H28 and Albite-microline.—North American Philips Co., Inc., 750 South Fulton Ave., Mount Vernon, N. Y.

Circle **804** on inquiry card.

ANALYTICAL

Gas Analyzer. New 4-page Bulletin 105 presents description, illustrations and specifications of maker's new supersensitive analyzer for detection of hazardous gases in low concentrations.—Taller & Cooper, 75 Front St., Brooklyn 1, N. Y.

Circle **805** on inquiry card.

Gas Analysis. New 12-page booklet covers directions for using maker's portable gas analyzers and methods for saving fuel. Price $.50.—Ellison Draft Gage Co., 548 W. Monroe St., Chicago 6, Ill.

Circle **806** on inquiry card.

Source Units. New 12-page illustrated Bulletin CH 328/3 covers construction and specifications of English-made controlled source units for spectroscopy.—Jarrell-Ash Co., 26 Farwell St., Newtonville, Mass.

Circle **807** on inquiry card.

Gas Analysis. New 2-page Bulletin AD-611 explains use of maker's equipment for industrial gas analysis in tunnel kilns.—Arnold O. Beckman Inc., 1020 Mission St. South Pasadena, Calif.

Circle **808** on inquiry card.

Gas Alarms. New 2-page Bulletin SM-1253-5M illustrates and describes maker's "Model SM" combustible-gas alarms for single-point industrial protection.—Johnson-Williams, Ltd., Palo Alto, Calif.

Circle **809** on inquiry card.

Gas Analysis. New 2-page Bulletin AD-613 presents, describes and illustrates maker's "Model G2" oxygen analyzer.—Arnold O. Beckman Inc., 1020 Mission Street, South Pasadena, Calif.

Circle **810** on inquiry card.

Conductivity Indicators. New 4-page Data Sheet E 95-(1) covers design and operating features, specifications and applications of maker's portable electrolytic conductivity indicators.—Leeds & Northrup Co., 4934 Stenton Ave., Phila. 44, Penna.

Circle **811** on inquiry card.

Stream Analysis. New 6-page illustrated brochure lists features, specifications, and applications of maker's continuous-process stream analyzers.—Perkin-Elmer Corp., Norwalk, Conn.

Circle **812** on inquiry card.

Density Measurement. New 4-page bulletin presents description, applications and diagrams of maker's new

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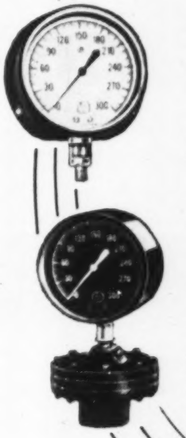

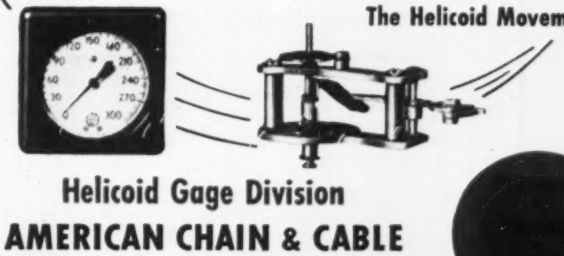

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MANUFACTURERS' NEW LITERATURE

"Densi-O-Meter" nuclear-electronic density-measuring instrument.—Sierra Industrial Instrument Co., 317 Fourth St., San Francisco 7, Calif.

Circle **813** on inquiry card.

Gas Analyzer. New 8-page booklet describes and illustrates maker's new portable gas analyzer for maintaining quality control in food packaging.—Crown Cork & Seal Co., Machine Sales Div., Baltimore 3, Md.

Circle **814** on inquiry card.

Mass Spectrometer. New 12-page Bulletin CEC-1824A covers operation, performance characteristics, specifications and features of maker's "Model 121-610" process-monitor mass spectrometer for continuous control of product quality.—Consolidated Engineering Corp., 300 North Sierra Madre Villa, Pasadena 15, Calif.

Circle **815** on inquiry card.

AIR, WATER

Water Demineralizer. New 6-page Bulletin 128 presents detailed description and applications of maker's pressure bantam, water demineralizer.—Barnstead Still & Sterilizer Co., 243 Lanesville Terrace, Forest Hills, Boston 31, Mass.

Circle **816** on inquiry card.

Air Trap. New 2-page bulletin lists applications, operation and construction of maker's "Model F-3030" automatic air trap.—Industrial Equipment Div. American Injector Co., Detroit 3, Mich.

Circle **817** on inquiry card.

Smoke Photometer. New 8-page Bulletin JM-1000-A describes, illustrates and gives operating principles of maker's forward-scattering aerosol and smoke photometer and accessories.—Phoenix Precision Instrument Co., 3803-05 N. Fifth St., Phila. 40, Pa.

Circle **818** on inquiry card.

VISCOSITY

Viscosity Measurement. New 4-page brochure presents principle of operation, technical description and installation features of maker's "Viscometran" for continuous indication, recording and control of viscosity under process conditions.—Brookfield Engineering Laboratories, Inc., 240 Cushing St., Stoughton, Mass.

Circle **819** on inquiry card.

TELEMETERING

Telemeters. New 44-page Bulletin M1710 illustrates and describes maker's line of "Metameter" telemetering equipment, and new "Metagraphic" recorders and indicators for use as receivers.—Bristol Co., Waterbury 20, Conn.

Circle **820** on inquiry card.

Telemetering Control. New 2-page bulletin describes and illustrates maker's new "Telestep" remote telemetering control system for industrial and municipal water and sewage systems.—Automatic Control Co., St. Paul 4, Minn.

Circle **821** on inquiry card.

Telemetering. New 4-page issue of "Autocon Rambler" (Vol. 4 No. 2) features articles on definition and applications of telemetering and maker's "Telestep" telemetering system.—Automatic Control Co., 1005 University Ave., St. Paul 4, Minn.

Circle **822** on inquiry card.

POWER SUPPLIES

Power Supplies. New 6-page illustrated catalog presents performance data, dimensions and weights of maker's new d-c. power supplies. New 4-page folder covers ten models of closely-regulated power supplies for development and research with outputs up to 1000 V. d-c. and 500 MA.—Dresden-Barnes Corp., 250 N. Vinedo Ave., Pasadena 8, Calif.

Circle **823** on inquiry card.

Power Supplies. New 8-page Bulletin EB-2 (March 1954) describes and pictures maker's five lines of regulated, d-c. power supplies. Includes laboratory precision, laboratory standard, twin units, fixed output and custom design.—Universal Electronics Co., 2012 South Sepulveda Blvd., Los Angeles 25, Calif.

Circle **824** on inquiry card.

Transformer-rectifiers. New 2-page Bulletin A453 describes maker's transformer-rectifiers rated at 28 volts

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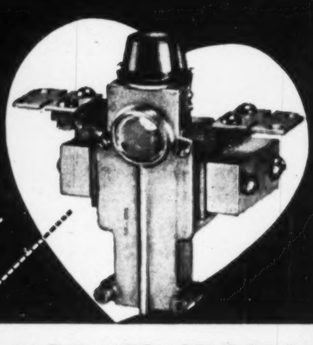

IN THE AUTOMOTIVE FIELD, the Bear Manufacturing Co. of Rock Island, Ill. uses Series 500 G-M Galvanometers in its new remote-reading Electric Wheel Alignment System (left). Whatever your own particular instrument field, you can achieve this same self-contained portability, ruggedness and high sensitivity with G-M Galvanometers. Complete catalog on request.

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with current ratings up to 200 amperes and complete power-supply units for airborne-radar application.—Perkin Engineering Corp., 345 Kansas St., El Segundo, Calif.

Circle **825** on inquiry card.

Cells, Batteries. New 8-page Booklet 1-7 discusses applications of maker's cells and batteries as power supply for transistor circuits.—P. R. Mallory & Co. Inc., North Tarrytown, N. Y.

Circle **826** on inquiry card.

Rectifiers. New 4-page issue of "International Rectifier News" RN-454 presents articles on selenium rectifiers, germanium diodes, meter protection and cross reference guide for Radio-TV selenium rectifiers.—International Rectifier Corp., 1525 East Grand Ave., El Segundo, Calif.

Circle **827** on inquiry card.

Instrument Generator. New 2-page Bulletin GPM-44A pictures and describes maker's permanent-magnet, continuous-duty instrument generator. —Dalmotor Co., 1342 Clay St., Santa Clara, Calif.

Circle **828** on inquiry card.

NAVIGATION

Compass System. New 12-page illustrated Bulletin GEA-5998 covers features, components, operation and specifications of maker's "Type MA-1" compass-controlled directional gyro system.—General Electric Co., Schenectady 5, N. Y.

Circle **829** on inquiry card.

ELECTRONIC INSTRUMENTS

VT Voltmeter. New 4-page issue of the "hp Journal" (Vol. 5 No. 9) features article on maker's new wide-range, high-stability 4-Mc. voltmeter. —Hewlett-Packard Co., 395 Page Mill Rd., Palo Alto, Calif.

Circle **830** on inquiry card.

Electronic Instruments. New 4-page illustrated brochure presents features and specifications of maker's transistor tester, power supply, constant-current converter, and audio-spectrum and constant-current generator.—Electronic Research Associates, Inc., Box 29, Caldwell, N. J.

Circle **831** on inquiry card.

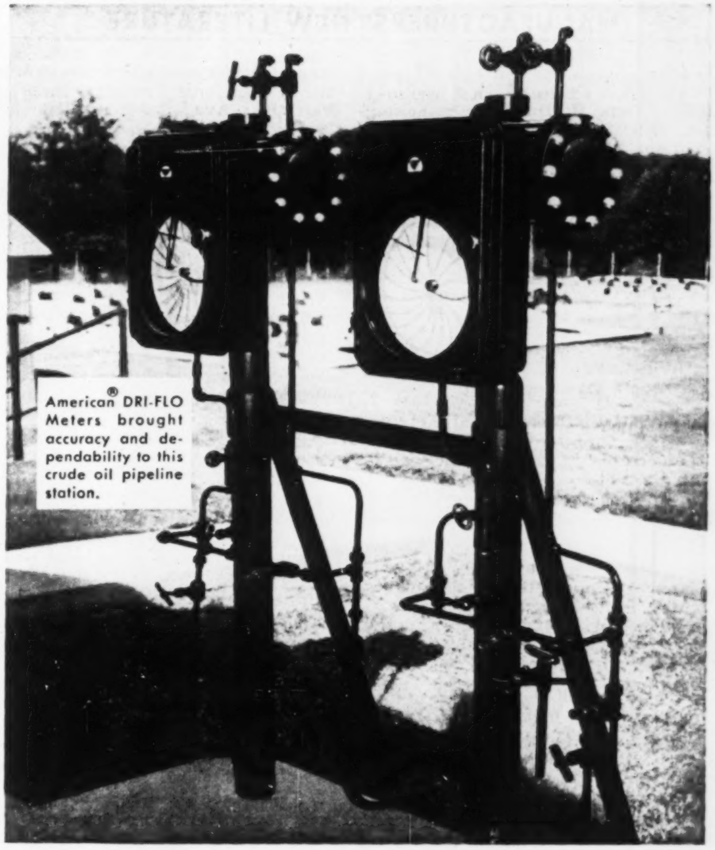
Audio Generator. New 8-page issue of "General Radio Experimenter" (Vol. 29 No. 1) features article on "Type 1304-B" beat-frequency audio generator.—General Radio Co., 275 Massachusetts Ave., Cambridge 39, Mass.

Circle **832** on inquiry card.

Switchboard Instruments. New 12-page Circular A-35-C describes and pictures maker's "Model 610 Group" switchboard instruments including voltmeters, ammeters, potential converters, power-factor meters, thermocouple instruments, etc.—Weston Electrical Instrument Corp., Newark 5, N. J.

Circle **833** on inquiry card.

Cathode-ray Oscillographs. New 24-page issue of "The Oscillographer" (Vol. 14 No. 4) presents articles on



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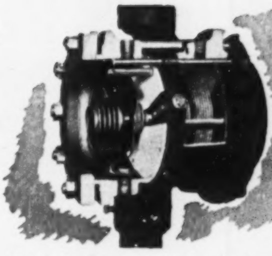
Do you have a tough metering problem?

Installed at Mid-Continent Pipe Line Company's booster station at Seminole, Oklahoma, these two American DRI-FLO Meters measure high pressure (900 PSI) crude oil in the pipelines to the Company's Tulsa Refinery.

Meter accuracy and dependability are completely satisfactory despite constant vibration and the "tough" nature of the job. No seal pots are required, eliminating "blown" seals and emulsified mercury. Because of the close proximity (70 feet) to the discharge of the booster pumps, the meter pipestands are mounted in a concrete platform and are specially braced. Meter indications, read from the office window, help dispatchers quickly locate troubles such as line breaks, pump or valve failures—and eliminate running high pressure oil lines to the dispatchers office.



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MANUFACTURERS' NEW LITERATURE

multiplier phototubes and new "Type 323" precision cathode-ray oscillographs.—Allen B. Du Mont Laboratories, Inc., Instrument Div., 760 Bloomfield Ave., Clifton, N. J.

Circle **834** on inquiry card.

Radiometer, Preamplifier. New 4-page illustrated Brochure ODC 407 lists features, applications and specifications of maker's "Type R-P2" infrared radiometer. 2-page Bulletin ODC-407-2 pictures and describes maker's "Type AB-P1" and "Type AB-P2" detector preamplifiers.—Olympic Development Co., 30 Commerce Rd., Stamford, Conn.

Circle **835** on inquiry card.

Ammeters, Voltmeters, Wattmeters. New 4-page Circular A-22-E describes and illustrates maker's "Model 901" group a-c. and d-c. portable ammeters, voltmeters, wattmeters.—Weston Electrical Instrument Corp., Newark, N. J.

Circle **836** on inquiry card.

Clamp Volt-ammeter. New 4-page Circular A-29-C describes maker's "Model 633" clamp-ammeter for measurement of amperes and volts.—Weston Electrical Instrument Corp., Newark, N. J.

Circle **837** on inquiry card.

Defibrillator. New 4-page illustrated Bulletin DP-154 describes maker's clinical defibrillator-pacemaker for use in ventricular fibrillation, cardiac standstill and conduction block.—Levinthal Electronic Products, Inc., 2887 Fair Oaks Ave., Redwood City, Calif.

Circle **838** on inquiry card.

Industrial TV. New 4-page Bulletin 1175 pictures and describes features and applications of maker's "Series 400" industrial television system for remote viewing of industrial operations.—Diamond Power Specialty Corp., Lancaster, Ohio.

Circle **839** on inquiry card.

Electronic Instruments. New 4-page illustrated brochure presents maker's instruments for testing feedback control systems, amplifiers, preamplifiers, controls, radiation-detection units, signal generators, etc.—Servo Corp. of America, New Hyde Park, N. Y.

Circle **840** on inquiry card.

VT Voltmeter. New 2-page bulletin lists features, uses and specification of maker's "Model J-1002" high-voltage vacuum tube voltmeter.—Jennings Radio Mfg. Corp., 970 McLaughlin Ave., P. O. Box 1278, San Jose 8, Calif.

Circle **841** on inquiry card.

Measuring Bridge. New 4-page Bulletin 630 presents construction, operation, and specifications of German made "Type ZK" single-knob measuring bridge with 6 resistance ranges from 40 milliohms to 50,000 ohms.—Herman H. Sticht Co., Inc., 27 Park Place, New York, N. Y.

Circle **842** on inquiry card.

Current Test Set. New 4-page bulletin describes, illustrates and diagrams maker's universal "60" alternating current test set.—Sensitive Research Instrument Corp., 9-11 Elm Ave., Mount Vernon, N. Y.

Circle **843** on inquiry card.

Electronic Instruments. New 6-page Catalog DMC-554 presents description and specifications of maker's full line of factory-wired electronic instruments and "build-it-yourself" kits.—Electronic Instrument., Inc., 84 Withers St., Brooklyn 11, N. Y.

Circle **844** on inquiry card.

High-frequency Heating. New 4-page illustrated Bulletin 5M-5-54 lists features, advantages and specifications of maker's "Models K400 10C" and "K400 20C Kilotron" for production-line high-frequency heating.—Electric-Arc Inc., 152 Jelliff Ave., Newark 8, N. J.

Circle **845** on inquiry card.

RESISTORS, POTENTIOMETERS

Resistor Guide. New 2-page "Official Resistor Engineering Guide" covers 130 types of maker's resistors and special products. Includes MIL or JAN equivalent, rated wattage, standard tolerances, temperature coefficient, maximum operating temperature, ohmic values available and dimensions.—International Resistance Co., 401 North Broad St., Phila. 8, Pa.

Circle **846** on inquiry card.

Potentiometer. New 2-page Bulletin B53 presents application advantages,

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10
15
20
25
30
INCHES OF WATER

MARSHALLTOWN

DIAPHRAGM GAUGE

For Accurate Pressure Measurement in Ounces or Inches of Water

Available in standard dials (reading in inches of water) 0-15" -0-30" -0-60" -0-100" -0-160" . . . also in ounce graduated dials from 15 ounces to 5 pounds. 2½", 3½" and 4½" dial sizes mounted in black enameled steel case.

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performance, design features and specifications of maker's "Type 2094" potentiometer with conductive-plastic resistance element.—Markite Corp., 155 Waverly Place, New York 14, N. Y.

Circle **847** on inquiry card.

Potentiometers. New 8-page brochure presents descriptions, photographs and diagrams of 6 basic models of maker's linear and non-linear, standard and power-type potentiometers.—DeJur-Amsco Corp., 45-01 Northern Blvd., L. I. C. 1, N. Y.

Circle **848** on inquiry card.

Resistors. New 2-page brochure lists features, specifications and characteristics of maker's precision wirewound resistors.—RHO Engineering Co., 4205 Sepulveda Blvd., Culver City, Calif.

Circle **849** on inquiry card.

Rheostats. New 2-page issue of "Ohmite News" (June) features article on use of maker's rheostats in luxury airliners. Also articles on heat control rheostat, chokes, suppressors and resistors.—Ohmite Manufacturing Co., 3603 Howard St., Skokie, Ill.

Circle **850** on inquiry card.

Resistors. New 14-page illustrated brochure presents engineering data, characteristics, and specifications of maker's standard, computer type, miniature, subminiature precision wire-wound resistors.—Eastern Precision Resistor Corp., Richmond Hill 18, N. Y.

Circle **851** on inquiry card.

RELAYS, SWITCHES

Relays. New 4-page illustrated bulletin presents features and applications of maker's miniature, telephone and time relays.—Kurman Electric Co., Inc., 35-18 37th St., L. I. C. 1, N. Y.

Circle **852** on inquiry card.

Electro-magnetic Relays. New 84-page booklet contains 23 papers presented at the "Second Symposium on Electro-magnetic Relays" held recently at Oklahoma Institute of Technology.—Potter & Brumfield, Princeton, Ind.

Circle **853** on inquiry card.

Relays. New 4-page illustrated brochure presents features and specifications of maker's electrical relays for general and special switching applications.—Hi-G Inc., Bradley Field, Windsor Locks, Conn.

Circle **854** on inquiry card.

Relays. New 4-page Bulletin 1002 presents operation, construction and applications of maker's "KP" relays.—Union Switch & Signal, Pittsburgh 18, Pa.

Circle **855** on inquiry card.

Switches. New 20-page Catalog 101 describes 258 different switches, actuators and enclosures. Includes dimensionalized photos, characteristics, electrical ratings and technical data.—Micro Switch, Freeport, Ill.

Circle **856** on inquiry card.

Switches. New 2-page illustrated brochure describes maker's 8-pole double throw switch for control of multiple machine operations.— Guard-

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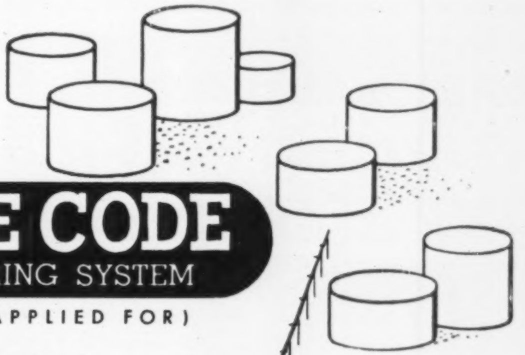

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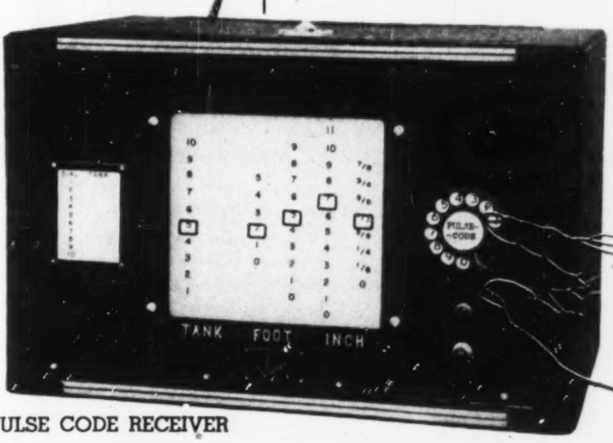

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NEW LITERATURE

ian Electric, 1621 W. Walnut St., Chicago 12, Ill.

Circle **857** on inquiry card.

Switches. New 2-page Bulletin 905 presents description, dimensions, wiring diagrams and applications for maker's reversing-drum switches for all ratings up to 2 hp.—Federal Electric Products Co., Industrial Controls Div., 1429 Park St., Hartford 6, Conn.

Circle **858** on inquiry card.

ELECTRONIC COMPONENTS

Contact Kit. New 2-page Bulletin illustrates and describes maker's new "Contact-Pak" which contains over 60 items most frequently needed for tests and prototype work involving contacts, commutators, etc.—J. M. Ney Co., 71 Elm St., Hartford 1, Conn.

Circle **859** on inquiry card.

Microwave Gas Tubes. New 6-page Bulletin A-20 presents nature, purpose and specifications of maker's microwave gas-control tubes, backward-wave oscillators, and traveling-wave tubes.—Roger White Electron Devices Inc., Route 17 & Erie R. R., Ramsey, N. J.

Circle **860** on inquiry card.

Differential Transformers. New 10-page Bulletin AA-1 presents description and diagrams of maker's linear variable differential transformers.—Schaevitz Engineering, P. O. Box 505, Camden 1, N. J.

Circle **861** on inquiry card.

Hi-fi Transformer. New 2-page Bulletin 33-3-54 describes and illustrates maker's "BO-13" ultra-linear high-fidelity output transformer.—Chicago Standard Transformer Corp., 3501 West Addison St., Chicago 18, Ill.

Circle **862** on inquiry card.

High-voltage Divider. New 2-page bulletin presents application, construction, and division ratios of maker's vacuum-capacitor voltage divider.—Jennings Radio Mfg. Corp., 970 McLaughlin Ave., P. O. Box 1278, San Jose 8, Calif.

Circle **863** on inquiry card.

Aircraft Connectors. New 8-page Bulletin BU-1 presents description, photographs, dimensional drawings and applications of maker's plugs and recepticals for aircraft buffet equipment.—Cannon Electric Co., P. O. Box 75, Lincoln Heights Station, Los Angeles 31, Calif.

Circle **864** on inquiry card.

Variable Inductors. New 8-page Bulletin 4/654 presents a set of variable inductor characteristic curves.—Vari-L Co., Inc., P. O. Box 1433, Stamford, Conn.

Circle **865** on inquiry card.

Inductors. New 2-page brochure lists uses, features and specifications of maker's "Type SL1" and "SL2" miniature inductors for use in tuned circuits and filter networks.—Micro Instrument Co., 80 Trowbridge St., Cambridge 38, Mass.

Circle **866** on inquiry card.

Inductors, Coils. New 8-page catalog describes and illustrates maker's line of coils and inductors including, R. F. solenoid coils, I. F. transformers, space- and close-wound solenoid coils, and universal-wound peaking coils.—Moran Electronics, 10515 Metropolitan Ave., Kensington, Md.

Circle **867** on inquiry card.

Connectors. New 2-page brochure presents description and specifications of maker's "Series C-20" single contact and "Series FHL" round miniature precision connectors.—DeJur-Amsco Corp., 45-01 Northern Blvd., L. I. C. 1, N. Y.

Circle **868** on inquiry card.

Variable-reluctance Microphone. New 6-page illustrated Bulletin 3-011 presents description, dimensions and wiring diagrams of maker's new "Transluctance" microphone featuring variable-reluctance pickup and transistor preamp.—Remler Co. Ltd., 2101 Bryant St., San Francisco 10, Calif.

Circle **869** on inquiry card.

Transformers. New 24-page Catalog S-654 lists replacement and new equipment transformers with complete electrical and physical specifications for over 500 transformers for radio, television, communications and electronic applications.—Chicago Standard Transformer Corp., Addison & Elston, Chicago 18, Ill.

Circle **870** on inquiry card.

TUBING

Tool Steel Tubing. New 4-page Data Memorandum #14 treats two grades of tool steel "AISI E-52100 Alloy Steel" and AISI E-1095 High-Carbon Steel" produced in small-diameter tubing form.—Superior Tube, 1564 Germantown Ave., Norristown, Penna.

Circle **871** on inquiry card.

Tubing Tools. New 16-page Booklet 3030 pictures and describes maker's line of tools for cutting, flaring, bending, swedging, reaming and pinch-off of tubing.—Imperial Brass Mfg. Co., 1200 West Harrison St., Chicago 7, Ill.

Circle **872** on inquiry card.

INSTRUMENT PARTS

Miniature Ball Bearings. New 20-page Catalog 53-54 presents applications, photographs, engineering data and descriptions of maker's miniature ball bearings. Includes radial, radial retainer, spring separator, separable, angular contact, pivot, thrust, etc.—Miniature Precision Bearings, Inc., Keene, N. H.

Circle **873** on inquiry card.

Gears. New illustrated brochure describes maker's precision stock gears and "Dynaco" gear design kits.—Dynamic Gear Co., Inc., Amityville, L. I., N. Y.

Circle **874** on inquiry card.

Pivot Polishing. New 8-page catalog illustrates and describes distributor's line of foreign-made pivot-polishing machines for watch and instrument industry.—Carl Hirschmann Co., 30 Park Ave., Manhasset, N. Y.

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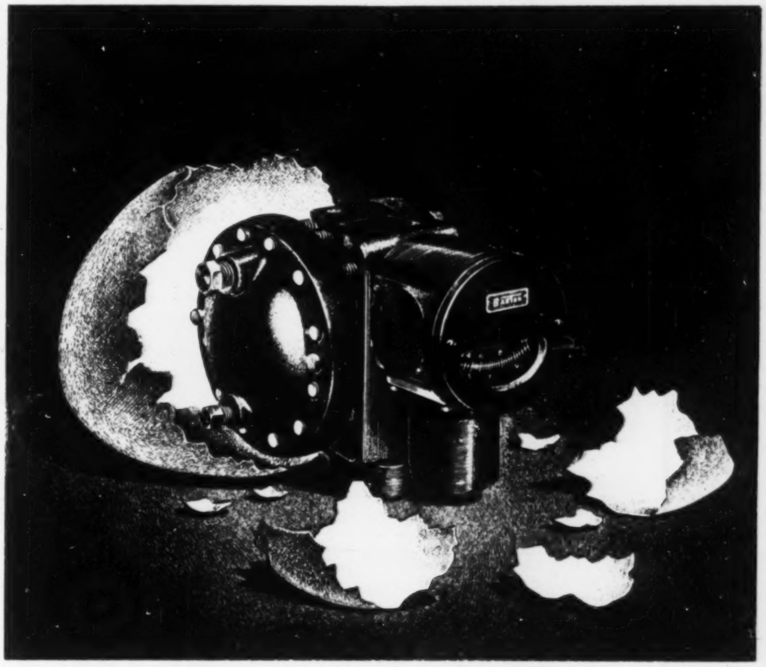
BARTON'S NEW BABY!



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NEW LITERATURE

Pivots, Bearings. New 48-page "Pivots and Bearings" is a collection of five reports of experiments and studies; including 20-page reprint "Weighing Machine Pivots" covering pivot theory and practice.—National Scalemen's Association, 608 S. Dearborn St., Chicago 5, Ill.

Circle **876** on inquiry card.

FABRICATION, SHOP EQUIPMENT

Turret Lathe. New 2-page bulletin describes and illustrates foreign made "Model Pirofa 45" turret lathe and attachments.—Cosa Corp., Chrysler Bldg., New York 17, N. Y.

Circle **877** on inquiry card.

Scale Models. New 4-page illustrated Booklet K describes manufacture and applications of maker's precision scale-models in metal, wood and plastic.—Arthur B. Johnson & Co., Inc., 392 East 201 St., New York 58, N. Y.

Circle **878** on inquiry card.

Screw Anchors. New 2-page Bulletin PA-254 describes and pictures maker's plastic screw anchors in new introductory kits.—Holub Industries, Inc., Sycamore, Ill.

Circle **879** on inquiry card.

Angle Drive. New 2-page brochure describes and gives illustrated assembly instructions for maker's new angle drive for drills and helical fluted taper pin reamers.—Beaver Tool Co., 622 East Jericho Turnpike, Huntington Station, N. Y.

Circle **880** on inquiry card.

Pipe Markers. New 6-page Bulletin 135-B presents description, illustrations and applications of maker's self-sticking, card-mounted, all-temperature pipe markers. Includes list of markings available.—W. H. Brady Co., 727 West Glendale Ave., Milwaukee 12, Wis.

Circle **881** on inquiry card.

Hydraulic Press. New 4-page bulletin presents description, features and specifications of maker's "Model PA-7" hydraulic press; 2-page illustrated brochure describes maker's 60 ton "H Type" press.—Pasadena Hydraulics Inc., 279 N. Hill Ave., Pasadena 4, Calif.

Circle **882** on inquiry card.

Industrial Equipment. New 24-page catalog illustrates and describes distributor's line of steel shelving, steel trucks, storage cabinets, ladders, welding benches, steel tables, etc.—Precision Equipment Co., 3656 Milwaukee Ave., Chicago 41, Ill.

Circle **883** on inquiry card.

MATERIALS

Spring Alloy. New 12-page Bulletins S-1, S-2, associated letter and set of reprints present maker's "Iso-Elastic" spring alloy for instruments where low hysteresis- and creep-errors are required. Includes specification sheets.—John Chatillon & Sons, 85 Cliff St., New York 38, N. Y.

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Beryllium-Copper Strip. New 4-page Technical Data Sheet 300 covers principal beryllium-copper alloys and precision mill limits to which strip is produced by maker. Includes charts and graphs on properties and tempers supplied, how to heat-treat alloys, and typical industrial applications of close-tolerance and thin-gage strip.—Industrial Div., American Silver Co., Inc., 36-07 Prince St., Flushing 54, N. Y.

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Platinum Clad. New 4-page Bulletin 4520 covers production, characteristics and applications of platinum cladding.—Baker & Co., 113 Astor St., Newark 5, N. J.

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Beryllium-Copper Strip. New 4-page Bulletin 2 presents information on "Penntemp" new type of mill-hardened beryllium copper strip that requires no heat treatment.—Penn Precision Products, Inc., 501 Crescent Ave., Reading, Pa.

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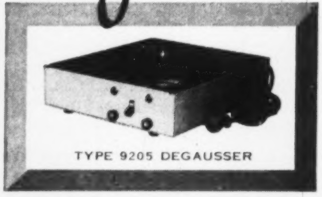
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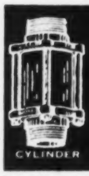

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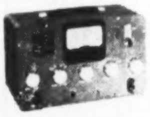

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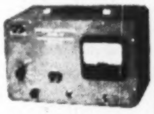

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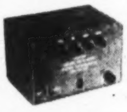

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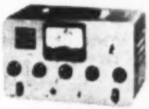

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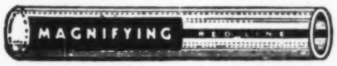

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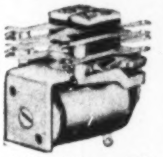

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Company ....

Products Manufactured ....

Company Address .... **City**.............................. **Zone**........ **State**..........................

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Advertised Products

1	21	41	61	81	101	121	141	161	181	201	221	241	261	281	301
2	22	42	62	82	102	122	142	162	182	202	222	242	262	282	302
3	23	43	63	83	103	123	143	163	183	203	223	243	263	283	303
4	24	44	64	84	104	124	144	164	184	204	224	244	264	284	304
5	25	45	65	85	105	125	145	165	185	205	225	245	265	285	305
6	26	46	66	86	106	126	146	166	186	206	226	246	266	286	306
7	27	47	67	87	107	127	147	167	187	207	227	247	267	287	307
8	28	48	68	88	108	128	148	168	188	208	228	248	268	288	308
9	29	49	69	89	109	129	149	169	189	209	229	249	269	289	309
10	30	50	70	90	110	130	150	170	190	210	230	250	270	290	310
11	31	51	71	91	111	131	151	171	191	211	231	251	271	291	311
12	32	52	72	92	112	132	152	172	192	212	232	252	272	292	312
13	33	53	73	93	113	133	153	173	193	213	233	253	273	293	313
14	34	54	74	94	114	134	154	174	194	214	234	254	274	294	314
15	35	55	75	95	115	135	155	175	195	215	235	255	275	275	315
16	36	56	76	96	116	136	156	176	196	216	236	256	276	296	
17	37	57	77	97	117	137	157	177	197	217	237	257	277	297	
18	38	58	78	98	118	138	158	178	198	218	238	258	278	298	
19	39	59	79	99	119	139	159	179	199	219	239	259	279	299	
20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	

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406	426	446	466	486	506	526	546	566	586	606	626	646	666
407	427	447	467	487	507	527	547	567	587	607	627	647	667
408	428	448	468	488	508	528	548	568	588	608	628	648	668
409	429	449	469	489	509	529	549	569	589	609	629	649	669
410	430	450	470	490	510	530	550	570	590	610	630	650	
411	431	451	471	491	511	531	551	571	591	611	631	651	
412	432	452	472	492	512	532	552	572	592	612	632	652	
413	433	453	473	493	513	533	553	573	593	613	633	653	
414	434	454	474	494	514	534	554	574	594	614	634	654	
415	435	455	475	495	515	535	555	575	595	615	635	655	
416	436	456	476	496	516	536	556	576	596	616	636	656	
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710	730	750	770	790	810	830	850	870	
711	731	751	771	791	811	831	851	871	
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718	738	758	778	798	818	838	858	878	
719	739	759	779	799	819	839	859	879	
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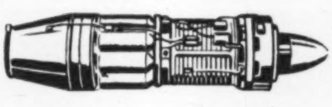

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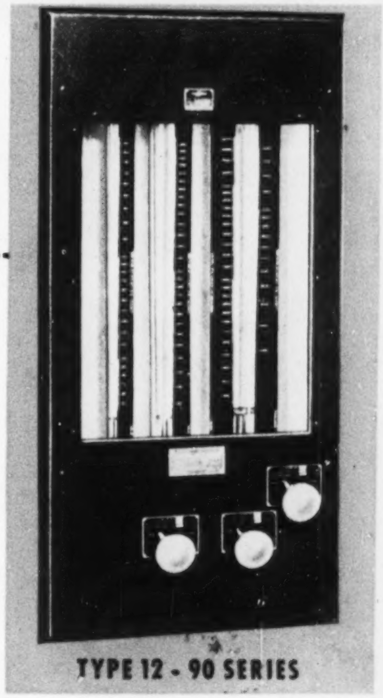

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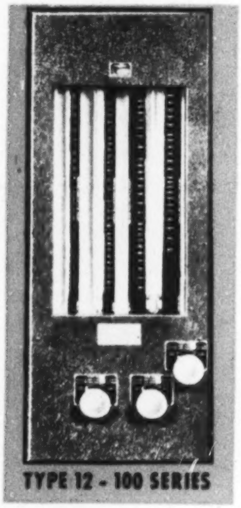

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